SEBM032410

SHOP MANUAL

KOMATSU

PC27MR-2, PC30MR-2
PC35MR-2, PC40MR-2
PC50MR-2

MACHINE MODEL	SERIAL NUMBER
PC27MR-2	15001 and up
PC30MR-2	20001 and up
PC35MR-2	5001 and up
PC40MR-2	8001 and up
PC50MR-2	5001 and up

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
  Materials and specifications are subject to change without notice.

- PC27MR-2 mount the 3D82AE-5M engine.
  PC30MR-2 mount the 3D84E-5N engine.
  PC35MR-2 mount the S3D84E-5PBA and 3D88E-5P engine.
  PC40, 50MR-2 mounts the 4D88E-5X engine.
  For details of the engine, see the 68E-88E Series Engine Shop Manual.

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SAFETY

SAFETY NOTICE

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, hand shield, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
    Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
14. When raising heavy components, use a hoist or crane.
    Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity.
    Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
    Replace any damaged parts with new parts.
    - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
    When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following chapters; these chapters are further divided into the each main group of components.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.
In addition, this section may contain hydraulic circuit diagrams, electric circuit diagrams, and maintenance standards.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.
Troubleshooting charts correlating "Problems" with "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the procedures for removing, installing, disassembling and assembling each component, as well as precautions for them.

MAINTENANCE STANDARD

This section gives the judgment standards for inspection of disassembled parts.
The contents of this section may be described in STRUCTURE AND FUNCTION.

OTHERS

This section mainly gives hydraulic circuit diagrams and electric circuit diagrams.
In addition, this section may give the specifications of attachments and options together.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Use the specifications given in the book with the latest date.

HOW TO READ THE SHOP MANUAL

VOLUMES
Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

Chassis volume: Issued for every machine model
Engine volume: Issued for each engine series
Electrical volume:
Attachments volume:
} Each issued as one volume to cover all models

These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

DISTRIBUTION AND UPDATING
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

FILING METHOD
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):

   10 - 3
   - 10: Item number (10. Structure and Function)
   - 3: Consecutive page number for each item.

   Example 2 (Engine volume):

   12 - 5
   - 1: Unit number (1. Engine)
   - 2: Item number (2. Testing and Adjusting)
   - 5: Consecutive page number for each item.

3. Additional pages: Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.
   Example:

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10-5		12-204

REVISED EDITION MARK

When a manual is revised, an edition mark ((1)(2)(3)....) is recorded on the bottom of the pages.

REVISIONS

Revised pages are shown in the LIST OF REVISED PAGES next to the CONTENTS page.

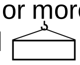
SYMBOLS

So that the shop manual can be of ample practical use, important safety and quality portions are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
★	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.
	Weight	Weight of parts of systems. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for the tightening torque during assembly.
	Coat	Places to be coated with adhesives and lubricants, etc.
	Oil, water	Places where oil, water or fuel must be added, and the capacity.
	Drain	Places where oil or water must be drained, and quantity to be drained.

HOISTING INSTRUCTIONS

HOISTING

> Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol 

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

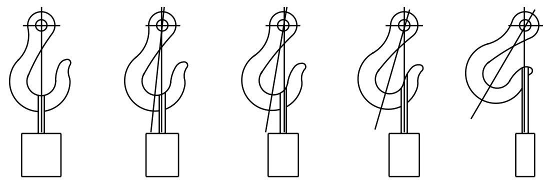
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.5	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

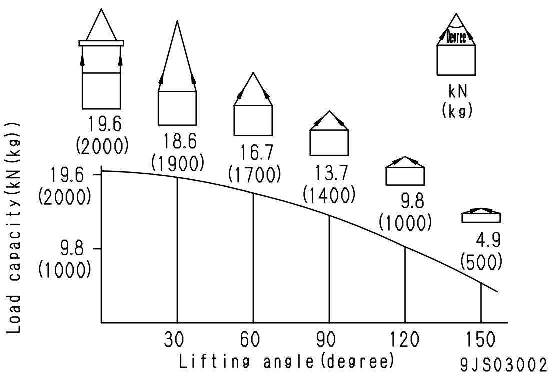
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

   Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
   When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
   When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



METHOD OF DISASSEMBLING, CONNECTING PUSH-PULL TYPE COUPLER

⚠ Before carrying out the following work, release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

⚠ Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.

Disconnection

1) Release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

2) Hold adapter (1) and push hose joint (2) into mating adapter (3). (See Fig. 1)
   ★ The adapter can be pushed in about 3.5 mm.
   ★ Do not hold rubber cap portion (4).

3) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against (3) until it clicks. (See Fig. 2)

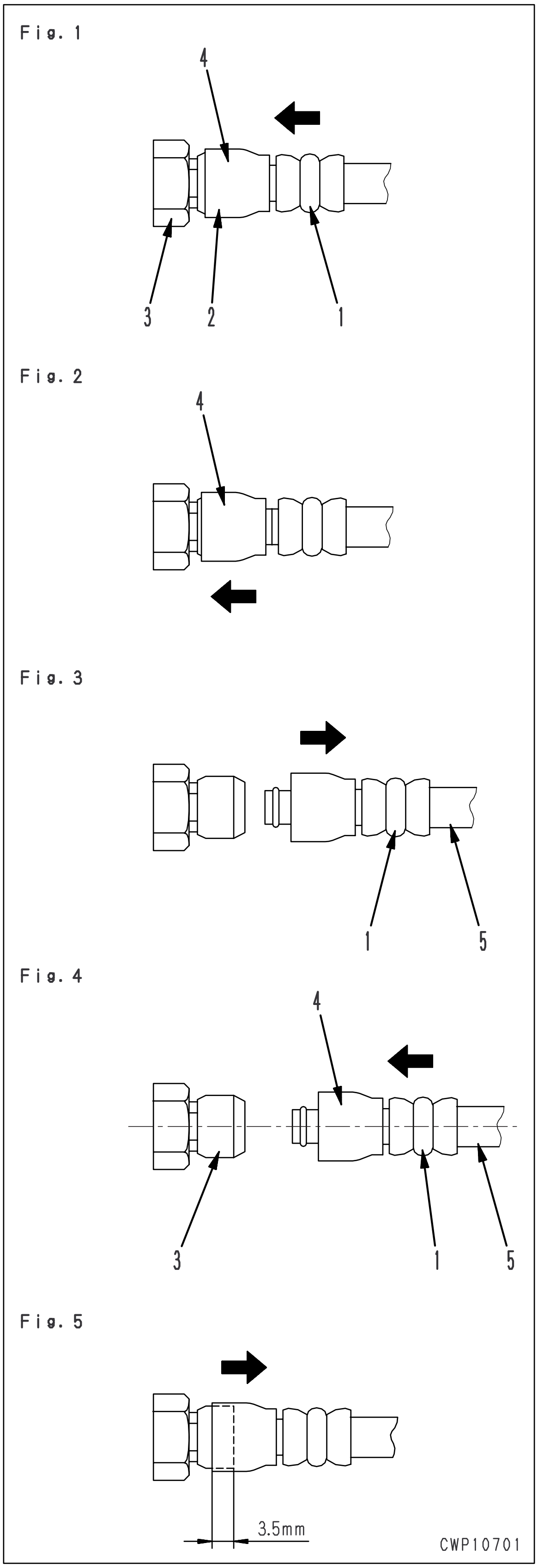
4) Hold hose adapter (1) or hose (5) and pull it out. (See Fig. 3)
   ★ Since some hydraulic oil flows out, prepare an oil receiving container.

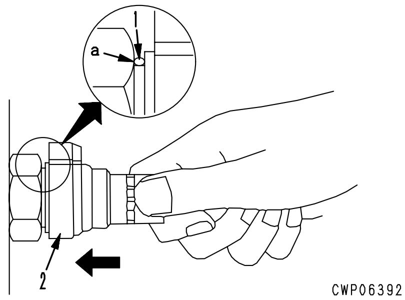
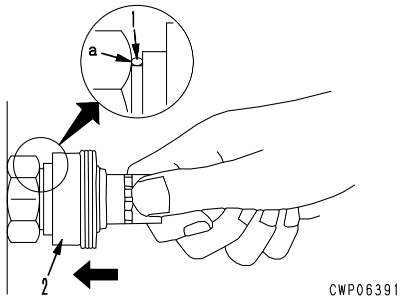
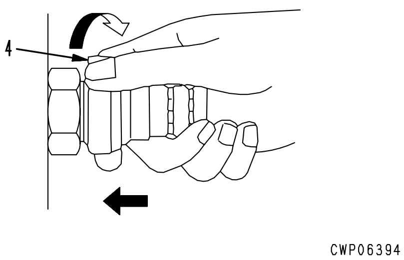
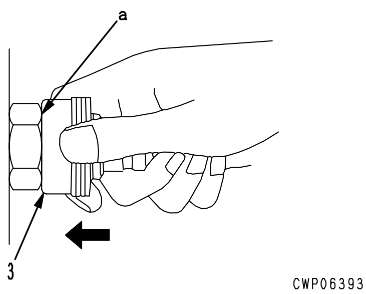
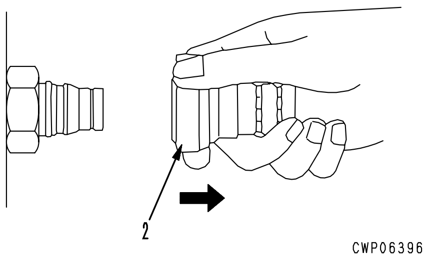
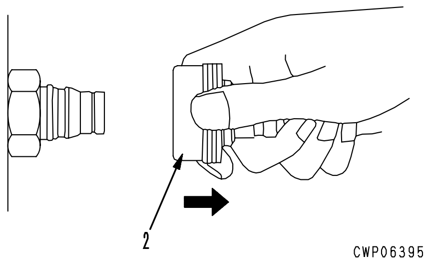
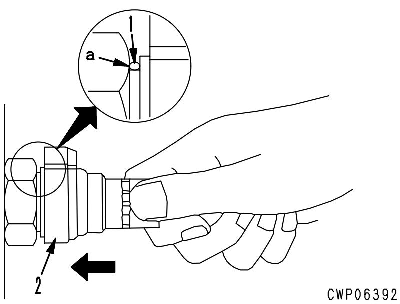
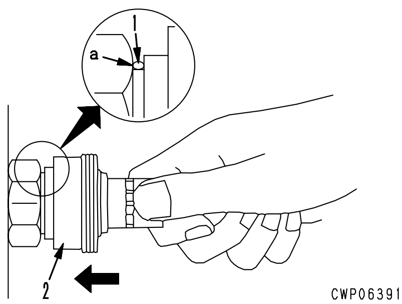
Connection

1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (See Fig. 4)
   ★ Do not hold rubber cap portion (4).

2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (See Fig. 5)
   ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.

Type 1



	Type 2	Type 3
Disassembly	1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface **a** of the hexagonal portion at the male end. 	1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface **a** of the hexagonal portion at the male end. 
	2) Hold in the condition in Step 1), and turn lever (4) to the right (clockwise). 	2) Hold in the condition in Step 1), and push until cover (3) contacts contact surface **a** of the hexagonal portion at the male end. 
	3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it. 	3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it. 
Connection	• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface **a** of the hexagonal portion at the male end to connect it. 	• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface **a** of the hexagonal portion at the male end to connect it. 

COATING MATERIALS

★ The recommended coating materials such as adhesives, gasket sealants and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this list.

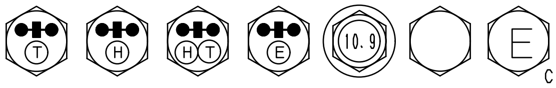
Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Adhesives	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions, and cock plug from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	• Used in places requiring an immediately effective, strong adhesive. Used for plastics (except polyethylene, polyprophylene, tetrafluoroethlene and vinyl chloride), rubber, metal and non-metal.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistance to heat and chemicals • Used for anti-loosening and sealant purpose for bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardening agent)	Adhesive: 1 kg Hardening agent: 500 g	Can	• Used as adhesive or sealant for metal, glass and plastic.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used as sealant for machined holes.
	Holtz MH 705	790-126-9120	75 g	Tube	• Used as heat-resisting sealant for repairing engine.
	Three bond 1735	790-129-9140	50 g	Polyethylene container	• Quick hardening type adhesive • Cure time: within 5 sec. to 3 min. • Used mainly for adhesion of metals, rubbers, plastics and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	• Quick hardening type adhesive • Quick cure type (max. strength after 30 minutes) • Used mainly for adhesion of rubbers, plastics and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Resistance to heat, chemicals • Used at joint portions subject to high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used as adhesive or sealant for gaskets and packing of power train case, etc.
	LG-5	790-129-9080	1 kg	Can	• Used as sealant for various threads, pipe joints, flanges. • Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	790-129-9020	200 g	Tube	• Features: Silicon based, resistance to heat, cold • Used as sealant for flange surface, tread. • Used as sealant for oil pan, final drive case, etc.
	LG-7	790-129-9070	1 kg	Tube	• Features: Silicon based, quick hardening type • Used as sealant for flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	• Used as heat-resisting sealant for repairing engine.
	Three bond 1207B	419-15-18131	100 g	Tube	• Features: Silicone type, heat resistant, vibration resistant, and impact resistant sealing material • Used as sealing material for transfer case

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features	
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	• Used as lubricant for sliding portion (to prevent from squeaking).	
	LM-P	09940-00040	200 g	Tube	• Used to prevent seizure or scuffling of the thread when press fitting or shrink fitting. • Used as lubricant for linkage, bearings, etc.	
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI	Various	Various	• General purpose type	
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various	Various	• Used for normal temperature, light load bearing at places in contact with water or steam.	
	Molybdenum disulphide grease LM-G (G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g × 10 400 g × 20 16 kg	Bellows type Bellows type Can	• Used for heavy load portion	
	Hyper White Grease G2-T G0-T (*) *: For use in cold district	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400 g 16 kg	Bellows type Can	• Seizure resistance and heat resistance higher than molybdenum disulfide grease • Since this grease is white, it does not stand out against machine body.	
	Biogrease G2B G2-BT (*) *: For high temperature and large load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400 g 16 kg	Bellows type Can	• Since this grease is decomposed by bacteria in short period, it has less effects on microorganisms, animals, and plants.	
Primer	SUNSTAR PAINT PRIMER 580 SUPER	417-926-3910	20 ml	Glass container	Adhesive for cab glass	• Used as primer for cab side (Using limit: 4 months)
	SUNSTAR GLASS PRIMER 580 SUPER		20 ml	Glass container		• Used as primer for glass side (Using limit: 4 months)
	SUNSTAR PAINT PRIMER 435-95	22M-54-27230	20 ml	Glass container		• Used as primer for painted surface on cab side (Using limit: 4 months)
	SUNSTAR GLASS PRIMER 435-41	22M-54-27240	150 ml	Can		• Used as primer for black ceramic-coated surface on glass side and for hard polycarbonate-coated surface (Using limit: 4 months)
	SUNSTAR SASH PRIMER GP-402	22M-54-27250	20 ml	Glass container		• Used as primer for sash (Alumite). (Using limit: 4 months)
Adhesive	SUNSTAR PENGUINE SUPER 560	22M-54-27210	320 ml	Ecocart (Special container)		• Used as adhesive for glass. (Using limit: 6 months)
	SUNSTAR PENGUINE SEAL 580 SUPER "S" or "W"	417-926-3910	320 ml	Polyethylene container		• "S" is used for high-temperature season (April - October) and "W" for low-temperature season (November - April) as adhesive for glass. (Using limit: 4 months)
	Sika Japan, Sikaflex 256HV	20Y-54-39850	310 ml	Polyethylene container		• Used as adhesive for glass. (Using limit: 6 months)
Caulking material	SUNSTAR PENGUINE SEAL No. 2505	417-926-3920	320 ml	Polyethylene container		• Used to seal joints of glass parts. (Using limit: 4 months)
	SEKISUI SILICONE SEALANT	20Y-54-55130	333 ml	Polyethylene container		• Used to seal front window. (Using limit: 6 months)
	GE TOSHIBA SILICONES TOSSEAL 381	22M-54-27220	333 ml	Cartridge		• Used to seal joint of glasses. Translucent white seal. (Using limit: 12 months)

STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUE TABLE (WHEN USING TORQUE WRENCH)

★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter of bolt	Width across flats	Tightening torque  CDL00372	
mm	mm	Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6 – 7.5
12	19	98 – 123	10 – 12.5
14	22	153 – 190	15.5 – 19.5
16	24	235 – 285	23.5 – 29.5
18	27	320 – 400	33 – 41
20	30	455 – 565	46.5 – 58
22	32	610 – 765	62.5 – 78
24	36	785 – 980	80 – 100
27	41	1150 – 1440	118 – 147
30	46	1520 – 1910	155 – 195
33	50	1960 – 2450	200 – 250
36	55	2450 – 3040	250 – 310
39	60	2890 – 3630	295 – 370

Thread diameter of bolt	Width across flats	Tightening torque  CDL00373	
mm	mm	Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	13	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	27	74.5 – 90.2	7.6 – 9.2

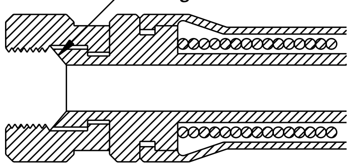


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TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

★ In the case of flared nuts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
14	19	24.5 ± 4.9	2.5 ± 0.5
18	24	49 ± 19.6	5 ± 2
22	27	78.5 ± 19.6	8 ± 2
24	32	137.3 ± 29.4	14 ± 3
30	36	176.5 ± 29.4	18 ± 3
33	41	196.1 ± 49	20 ± 5
36	46	245.2 ± 49	25 ± 5
42	55	294.2 ± 49	30 ± 5

TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS

★ In the case of split flange bolts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10 12 16	14 17 22	59 – 74 98 – 123 235 – 285	6 – 7.5 10 – 12.5 23.5 – 29.5

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PIPING JOINTS

★ Unless there are special instructions, tighten the O-ring boss piping joints to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque (Nm {kgm})	
	mm	mm	Range	Target
02 03, 04 05, 06 10, 12 14	14 20 24 33 42	Varies depending on type of connector.	35 – 63 {3.5 – 6.5} 84 – 132 {8.5 – 13.5} 128 – 186 {13.0 – 19.0} 363 – 480 {37.0 – 49.0} 746 – 1010 {76.0 – 103}	44 {4.5} 103 {10.5} 157 {16.0} 422 {43.0} 883 {90.0}

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PLUGS

★ Unless there are special instructions, tighten the O-ring boss plugs to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque (Nm {kgm})	
	mm	mm	Range	Target
08	08	14	5.88 – 8.82 {0.6 – 0.9}	7.35 {0.75}
10	10	17	9.8 – 12.74 {1.0 – 1.3}	11.27 {1.15}
12	12	19	14.7 – 19.6 {1.5 – 2.0}	17.64 {1.8}
14	14	22	19.6 – 24.5 {2.0 – 2.5}	22.54 {2.3}
16	16	24	24.5 – 34.3 {2.5 – 3.5}	29.4 {3.0}
18	18	27	34.3 – 44.1 {3.5 – 4.5}	39.2 {4.0}
20	20	30	44.1 – 53.9 {4.5 – 5.5}	49.0 {5.0}
24	24	32	58.8 – 78.4 {6.0 – 8.0}	68.6 {7.0}
30	30	32	93.1 – 122.5 {9.5 – 12.5}	107.8 {11.0}
33	33	—	107.8 – 147.0 {11.0 – 15.0}	124.4 {13.0}
36	36	36	127.4 – 176.4 {13.0 – 18.0}	151.9 {15.5}
42	42	—	181.3 – 240.1 {18.5 – 24.5}	210.7 {21.5}
52	52	—	274.4 – 367.5 {28.0 – 37.5}	323.4 {33.0}

TIGHTENING TORQUE FOR 102 AND 114 ENGINE SERIES

1) BOLT AND NUTS

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

2) EYE JOINTS

Use these torques for eye joints (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

3) TAPERED SCREWS

Use these torques for tapered screws (unit: inch) of Cummins Engine.

Thread diameter	Tightening torque	
inch	Nm	kgm
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.20
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

TIGHTENING TORQUE TABLE FOR HOSES (TAPER SEAL TYPE AND FACE SEAL TYPE)

★ Tighten the hoses (taper seal type and face seal type) to the following torque, unless otherwise specified.

★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal size of hose	Width across flats	Tightening torque (Nm {kgm})		Taper seal type	Face seal type	
		Range	Target	Thread size (mm)	Nominal thread size - Threads per inch, Thread series	Root diameter (mm) (Reference)
02	19	34 – 54 {3.5 – 5.5}	44 {4.5}	–	$\frac{9}{16}$ – 18UN	14.3
		34 – 63 {3.5 – 6.5}	44 {4.5}	14	–	–
03	22	54 – 93 {5.5 – 9.5}	74 {7.5}	–	$\frac{11}{16}$ – 16UN	17.5
	24	59 – 98 {6.0 – 10.0}	78 {8.0}	18	–	–
04	27	84 – 132 {8.5 – 13.5}	103 {10.5}	22	$\frac{13}{16}$ – 16UN	20.6
05	32	128 – 186 {13.0 – 19.0}	157 {16.0}	24	1 – 14UNS	25.4
06	36	177 – 245 {18.0 – 25.0}	216 {22.0}	30	$1\frac{3}{16}$ – 12UN	30.2
(10)	41	177 – 245 {18.0 – 25.0}	216 {22.0}	33	–	–
(12)	46	197 – 294 {20.0 – 30.0}	245 {25.0}	36	–	–
(14)	55	246 – 343 {25.0 – 35.0}	294 {30.0}	42	–	–

ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires.
This wire code table will help you understand WIRING DIAGRAMS.
Example: 5WB indicates a cable having a nominal number 5 and white coating with black stripe.

CLASSIFICATION BY THICKNESS

Norminal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number of strands	Dia. of strands (mm^2)	Cross section (mm^2)			
0.85	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
2	26	0.32	2.09	3.1	20	Lighting, signal etc.
5	65	0.32	5.23	4.6	37	Charging and signal
15	84	0.45	13.36	7.0	59	Starting (Glow plug)
40	85	0.80	42.73	11.4	135	Starting
60	127	0.80	63.84	13.6	178	Starting
100	217	0.80	109.1	17.6	230	Starting

CLASSIFICATION BY COLOR AND CODE

Priori-ty	Classi-fication \ Circuits		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
1	Pri-mary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxi-liary	Code	WR	—	BW	RW	YR	GW	LW
		Color	White & Red	—	White & Black	Red & White	Rellow & Red	Green & White	Blue & White
3		Code	WB	—	BY	RB	YB	GR	LR
		Color	White & Black	—	Black & Yellow	Red & Black	Yellow & Black	Green & Red	Blue & Yellow
4		Code	WL	—	BR	RY	YG	GY	LY
		Color	White & Blue	—	Black & Red	Red & Yellow	Yellow & Green	Green & Yellow	Blue & Yellow
5		Code	WG	—	—	RG	YL	GB	LB
		Color	White & Green	—	—	Red & Green	Yellow & Blue	Green & Black	Blue & Black
6		Code	—	—	—	RL	YW	GL	—
		Color	—	—	—	Red & Blue	Yellow & White	Green & Blue	—

CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

EXAMPLE

- Method of using the Conversion Table to convert from millimeters to inches

1. Convert 55 mm into inches.
   (1) Locate the number 50 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
   (2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
   (3) Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.
2. Convert 550 mm into inches.
   (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
   (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
   (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

(B)

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
(A) 50	1.969	2.008	2.047	2.087	2.126	(C) 2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimeters to Inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
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90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liter to U.K. Gallon

1ℓ = 0.21997 U.K. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.969	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft. lb

1 kgm = 7.233 ft. lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm² to lb/in²

1kg/cm² = 14.2233 lb/in²

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	1863	1877	1892	1906	1920	1934	1949	1963	1977
140	1991	2005	2020	2034	2048	2062	2077	2091	2105	2119
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	2603	2617	2631	2646	2660	2674	2688
190	2702	2717	2731	2745	2759	2773	2788	2802	2816	2830
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

Temperature

Fahrenheit-Centigrade Conversion ; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.
These figures refer to the temperature in either Fahrenheit or Centigrade degrees.
If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
–40.4	**–40**	–40.0	–11.7	**11**	51.8	7.8	**46**	114.8	27.2	**81**	117.8
–37.2	**–35**	–31.0	–11.1	**12**	53.6	8.3	**47**	116.6	27.8	**82**	179.6
–34.4	**–30**	–22.0	–10.6	**13**	55.4	8.9	**48**	118.4	28.3	**83**	181.4
–31.7	**–25**	–13.0	–10.0	**14**	57.2	9.4	**49**	120.2	28.9	**84**	183.2
–28.9	**–20**	–4.0	–9.4	**15**	59.0	10.0	**50**	122.0	29.4	**85**	185.0
–28.3	**–19**	–2.2	–8.9	**16**	60.8	10.6	**51**	123.8	30.0	**86**	186.8
–27.8	**–18**	–0.4	–8.3	**17**	62.6	11.1	**52**	125.6	30.6	**87**	188.6
–27.2	**–17**	1.4	–7.8	**18**	64.4	11.7	**53**	127.4	31.1	**88**	190.4
–26.7	**–16**	3.2	–7.2	**19**	66.2	12.2	**54**	129.2	31.7	**89**	192.2
–26.1	**–15**	5.0	–6.7	**20**	68.0	12.8	**55**	131.0	32.2	**90**	194.0
–25.6	**–14**	6.8	–6.1	**21**	69.8	13.3	**56**	132.8	32.8	**91**	195.8
–25.0	**–13**	8.6	–5.6	**22**	71.6	13.9	**57**	134.6	33.3	**92**	197.6
–24.4	**–12**	10.4	–5.0	**23**	73.4	14.4	**58**	136.4	33.9	**93**	199.4
–23.9	**–11**	12.2	–4.4	**24**	75.2	15.0	**59**	138.2	34.4	**94**	201.2
–23.3	**–10**	14.0	–3.9	**25**	77.0	15.6	**0**	140.0	35.0	**95**	203.0
–22.8	**–9**	15.8	–3.3	**26**	78.8	16.1	**61**	141.8	35.6	**96**	204.8
–22.2	**–8**	17.6	–2.8	**27**	80.6	16.7	**62**	143.6	36.1	**97**	206.6
–21.7	**–7**	19.4	–2.2	**28**	82.4	17.2	**63**	145.4	36.7	**98**	208.4
–21.1	**–6**	21.2	–1.7	**29**	84.2	17.8	**64**	147.2	37.2	**99**	210.2
–20.6	**–5**	23.0	–1.1	**30**	86.0	18.3	**65**	149.0	37.8	**100**	212.0
–20.0	**–4**	24.8	–0.6	**31**	87.8	18.9	**66**	150.8	40.6	**105**	221.0
–19.4	**–3**	26.6	0	**32**	89.6	19.4	**67**	152.6	43.3	**110**	230.0
–18.9	**–2**	28.4	0.6	**33**	91.4	20.0	**68**	154.4	46.1	**115**	239.0
–18.3	**–1**	30.2	1.1	**34**	93.2	20.6	**69**	156.2	48.9	**120**	248.0
–17.8	**0**	32.0	1.7	**35**	95.0	21.1	**70**	158.0	51.7	**125**	257.0
–17.2	**1**	33.8	2.2	**36**	96.8	21.7	**71**	159.8	54.4	**130**	266.0
–16.7	**2**	35.6	2.8	**37**	98.6	22.2	**72**	161.6	57.2	**135**	275.0
–16.1	**3**	37.4	3.3	**38**	100.4	22.8	**73**	163.4	60.0	**140**	284.0
–15.6	**4**	39.2	3.9	**39**	102.2	23.3	**74**	165.2	62.7	**145**	293.0
–15.0	**5**	41.0	4.4	**40**	104.0	23.9	**75**	167.0	65.6	**150**	302.0
–14.4	**6**	42.8	5.0	**41**	105.8	24.4	**76**	168.8	68.3	**155**	311.0
–13.9	**7**	44.6	5.6	**42**	107.6	25.0	**77**	170.6	71.1	**160**	320.0
–13.3	**8**	46.4	6.1	**43**	109.4	25.6	**78**	172.4	73.9	**165**	329.0
–12.8	**9**	48.2	6.7	**44**	111.2	26.1	**79**	174.2	76.7	**170**	338.0
–12.2	**10**	50.0	7.2	**45**	113.0	26.7	**80**	176.0	79.4	**175**	347.0

UNITS

In this manual, the measuring units are indicated with Internatinal System of units (SI).
As for reference, conventionally used Gravitational System of units are indicated in parentheses { }.

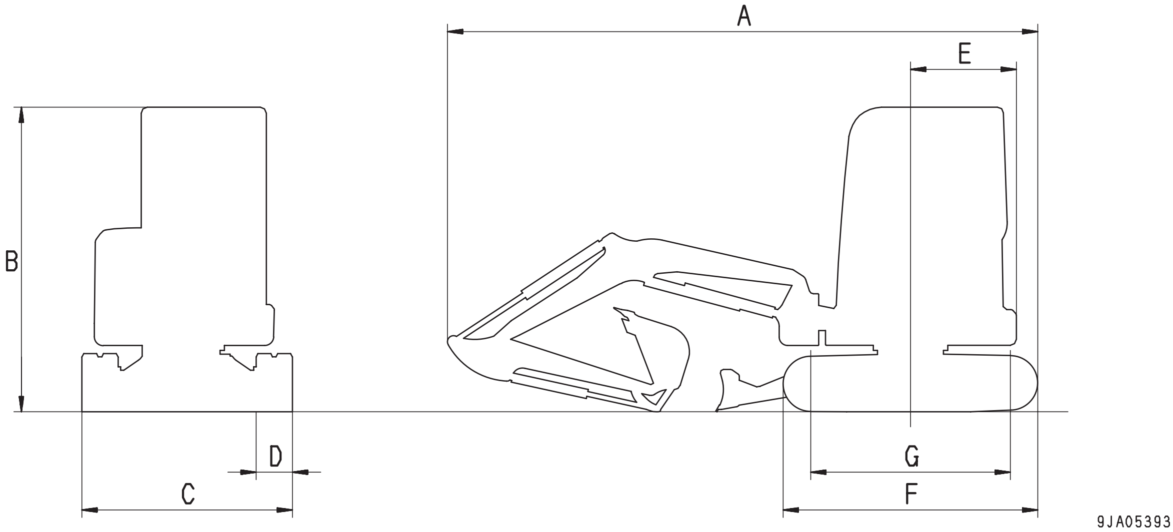
Example:

N {kg}
Nm {kgm}
MPa {kg/cm^2}
kPa {mmH$_2$O}
kPa {mmHg}
kW/rpm {HP/rpm}
g/kWh {g/HPh}

01 GENERAL

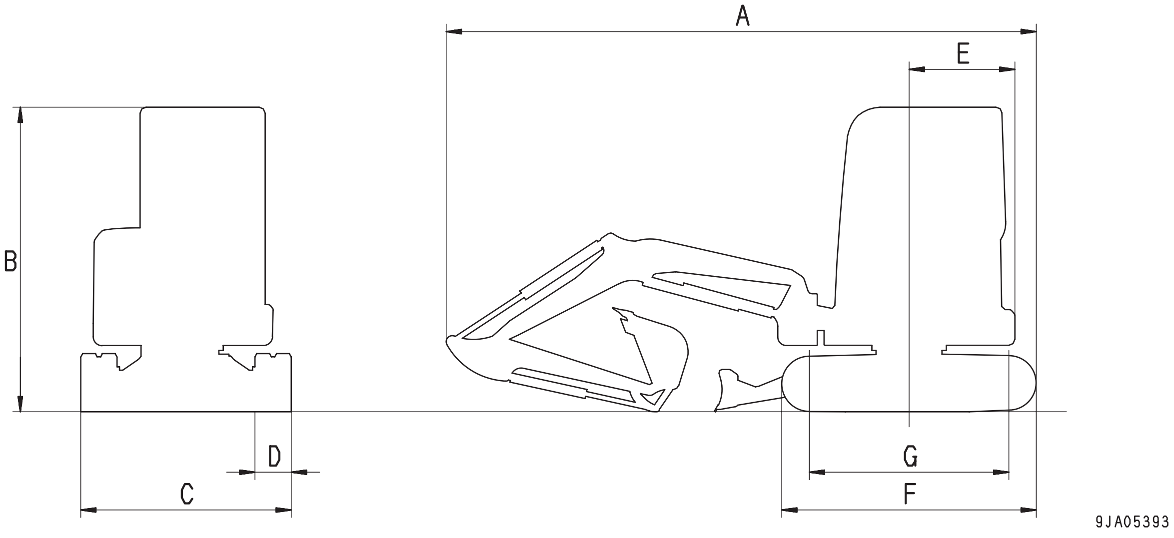
SPECIFICATION DIMENSION DRAWING 01- 2
WORKING RANGE DRAWING 01-3-1
SPECIFICATIONS 01- 4
WEIGHT TABLE 01-16
LUBRICANTS, FUEL AND COOLANT SPECIFICATIONS 01-20

SPECIFICATION DIMENSION DRAWING



	Item		Unit	PC27MR-2	PC30MR-2	PC35MR-2	PC35MR-2 (High altitude spec. S/No. 6736 and up)
	Machine weight	Canopy specification	kg	2,990 <2,780>	3,180 <2,990>	3,740 <3,580>	
		Cab specification		3,165 <2,955>	3,355 <3,165>	3,915 <3,755>	3,930 <3,770>
	Bucket capacity		m^3	0.08	0.09	0.11	
	Engine model		—	Komatsu 3D82AE-5M Diesel engine	Komatsu 3D84E-5N Diesel engine	Komatsu 3D88E-5P Diesel engine	Komatsu S3D84E-5PBA Diesel engine
	Rated engine output		kW{HP}/rpm	18.9 {25.3} / 2,600	20.6 {27.6} / 2,500	21.7 {29.1} / 2,400	23.9 {32.5} / 2,400
A	Overall length		mm	4,320	4,630	4,850	
B	Overall height		mm	2,530			
C	Overall width		mm	1,550		1,740	
D	Shoe width		mm	300			
E	Tail swing radius	Canopy specification	mm	855 <775>		950 <870>	
		Cab specification		885 <885>		950 <885>	
F	Overall length of track		mm	1,950	2,105		
G	Distance between tumbler centers		mm	1,485	1,650		
	Minimum ground clearance		mm	320		290	
	Travel speed (Low / High)		km/h	2.6 / 4.6		2.8 / 4.6	
	Continuous swing speed		rpm	9.2	9.3	9.0	

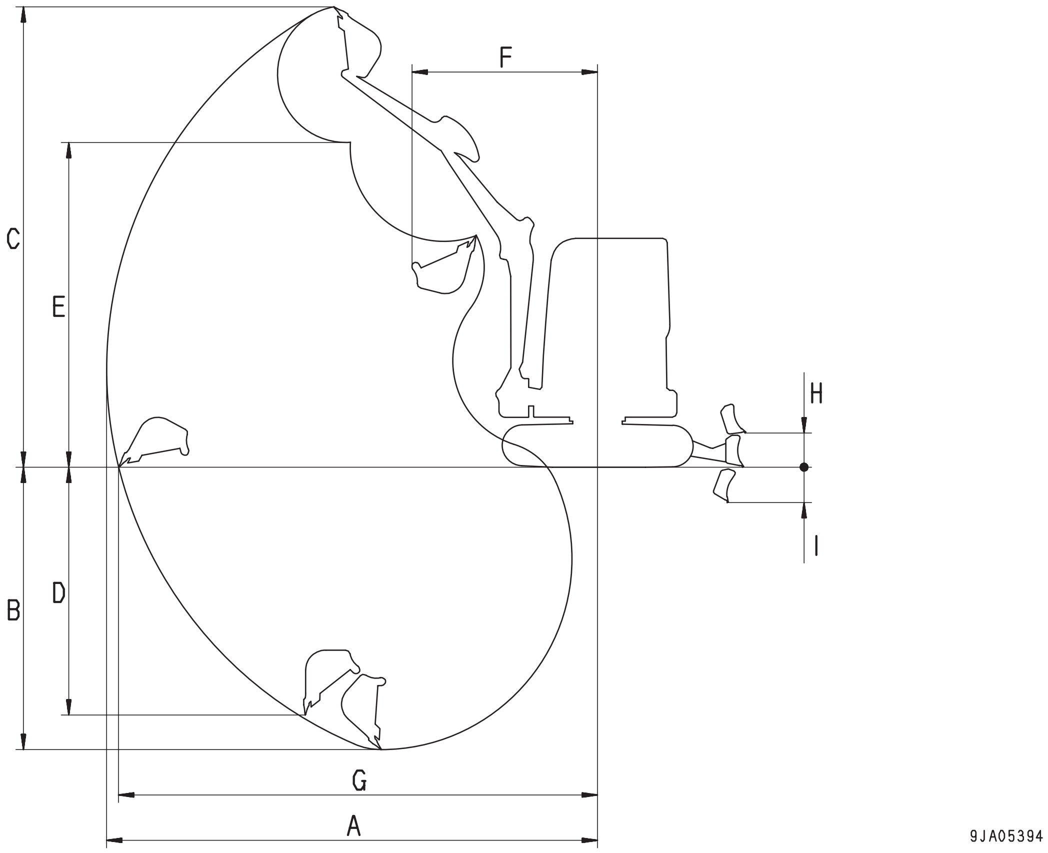
★ Values in < > are for the X-weightless specifications.



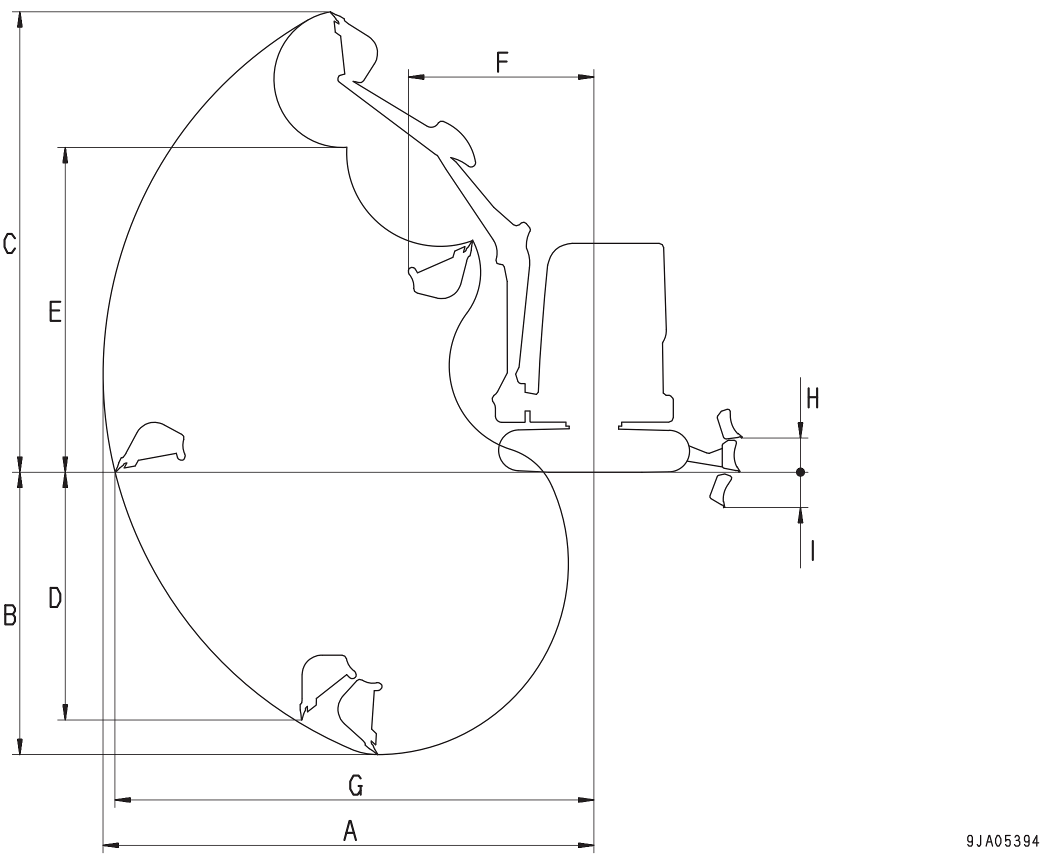
	Item		Unit	PC40MR-2	PC50MR-2
	Machine weight	Canopy specification	kg	4,790 <4,540>	5,040 <4,790>
		Cab specification		4,940 <4,690>	5,190 <4,940>
	Bucket capacity		m^3	0.14	0.16
	Engine model		—	Komatsu 4D88E-5X Diesel engine	
	Rated engine output		kW{HP}/rpm	29.4 {39.4} / 2,350	
A	Overall length		mm	5,390	5,550
B	Overall height		mm	2,625	
C	Overall width		mm	1,960	
D	Shoe width		mm	400	
E	Tail swing radius	Canopy specification	mm	1,060 <980>	
		Cab specification		1,060 <980>	
F	Overall length of track		mm	2,520	
G	Distance between tumbler centers		mm	2,000	
	Minimum ground clearance		mm	320	
	Travel speed (Low / High)		km/h	2.8 / 4.6	
	Continuous swing speed		rpm	9.0	

★ Values in < > are for the X-weightless specifications.

WORKING RANGE DRAWING



	Working range (mm)	PC27MR-2	PC30MR-2	PC35MR-2	PC35MR-2 (High altitude spec. S/No. 6736 and up)
A	Max. digging radius	4,700	5,150	5,360	5,360
B	Max. digging depth	2,650	2,910	3,170	3,170
C	Max. digging height	4,500	4,950	5,010	5,010
D	Max. vertical wall depth	2,185	2,650	2,720	2,720
E	Max. dumping height	3,230	3,450	3,530	3,530
F	Swing radius of work equipment <Values in ( ) are boom swing radii>	1,910 (1,510)	2,010 (1,510)	2,080 (1,590)	2,080 (1,590)
G	Max. reach at ground level	4,550	5,060	5,225	5,225
H	Blade lifting height	360	360	360	360
I	Blade lowering depth	315	310	390	390



	Working range (mm)	PC40MR-2	PC50MR-2
A	Max. digging radius	5,870	6,220
B	Max. digging depth	3,500	3,800
C	Max. digging height	5,570	5,945
D	Max. vertical wall depth	2,770	3,020
E	Max. dumping height	3,860	4,230
F	Swing radius of work equipment <Values in ( ) are boom swing radii>	2,270 (1,740)	2,270 (1,740)
G	Max. reach at ground level	5,710	6,070
H	Blade lifting height	430	430
I	Blade lowering depth	330	330

SPECIFICATIONS

Machine model				PC27MR-2	
				Canopy specification	Cab specification
Serial number				15001 and up	
Bucket capacity			m³	0.08	0.08
Operating weight			kg	2,990 <2,780> [2,875]	3,165 <2,955> [3,050]
Performance	Working ranges	Max. digging depth	mm	2,650	2,650
		Max. vertical wall depth	mm	2,185	2,185
		Max. digging reach	mm	4,700	4,700
		Max. reach at ground level	mm	4,550	4,550
		Max. digging height	mm	4,500	4,500
		Max. dumping height	mm	3,230	3,230
		Bucket offset	mm	580 (L.H.), 845 (R.H.)	580 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360	360
		Max. blade lowering depth	mm	315	315
	Max. digging force (bucket)		kN {kg}	21.9 {2,230}	21.9 {2,230}
	Continuous swing speed		rpm	9.2	9.2
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.6 (Lo) / 4.6 (Hi)	2.6 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm²}	29.8 {0.30} <27.7 {0.28}> [28.4 {0.29}]	31.3 {0.32} <29.2 {0.30}> [30.1 {0.31}]
Dimensions	Overall length (for transport)		mm	4,320	4,320
	Overall width		mm	1,550	1,550
	Overall height (for transport)		mm	2,530 [2,525]	2,530 [2,525]
	Ground clearance of conterweight		mm	545 [540]	545 [540]
	Min. ground clearance		mm	320 [320]	320 [320]
	Tail swing radius		mm	855 <775>	885 <885>
	Min. swing radius of work equipment (at boom swing)		mm	1,910 (1,510)	1,910 (1,510)
	Height of work equipment at min. swing radius		mm	3,440	3,440
	Overall width of crawler		mm	1,550	1,550
	Overall length of crawler		mm	1,950	1,950
	Distance between tumbler centers		mm	1,485	1,485
	Track gauge		mm	1,250	1,250
	Machine cab height		mm	1,380	1,380
	Blade width x height		mm	1,550 x 325	1,550 x 325

★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model				PC27MR-2 Canopy specification	PC27MR-2 Cab specification
Serial number				15001 and up	
Engine		Model		3D82AE-5M	
Engine		Type		4-cycle, water cooled, in-line direct injection type	
Engine		No. of cylinders – bore x stroke	mm	3 – 82 x 84	
Engine		Piston displacement	ℓ {cc}	1.330 {1,330}	
Engine	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	18.9 / 2,600 {25.7 / 2,600}	
Engine	Performance	Maximum torque	Nm/rpm {kgm/rpm}	83.2 / 1,560 {8.4 / 1,560}	
Engine	Performance	High idle speed	rpm	2,780	
Engine	Performance	Low idle speed	rpm	1,250	
Engine	Performance	Min. fuel consumption ratio	g/kWh {g/HPh}	235 {173}	
Engine		Starting motor		12V, 2.0kW	
Engine		Alternator		12V, 40A	
Engine		Battery (*1)		12V, 58Ah x 1 (90D26L)	
Engine		Radiator • Core type		CF34-1	
Under-carriage		Carrier roller		1 on each side	
Under-carriage		Track roller		4 on each side	
Under-carriage		Track shoe (Rubber shoe)		Unit-type rubber crawler	
Under-carriage		Track shoe (Steel shoe)		Assembly-type double grouser: 40 each side	
Hydraulic system	Hydraulic pump	Type x no.		Variable displacement piston type x 1, gear type x 1	
Hydraulic system	Hydraulic pump	Theoretical capacity	cm^3/rev	30 + 8.5	
Hydraulic system	Hydraulic pump	Set pressure For travel, work equipment For swing For blade	 MPa {kg/cm^2} MPa {kg/cm^2} MPa {kg/cm^2}	 24.5 {250} 17.2 {175} 21.1 {215}	
Hydraulic system	Control valve	Type x no.		9-spool type x 1	
Hydraulic system	Control valve	Control method		Hydraulic assist type	
Hydraulic system	Hydraulic motor	Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2	
Hydraulic system	Hydraulic motor	Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1	
Hydraulic system		Hydraulic tank		Box-shaped, open type	
Hydraulic system		Hydraulic oil filter		Tank return side	
Hydraulic system		Hydraulic oil cooler		Air cooled (Drawn-CUP)	
Hydraulic system	Work equipment cylinder – Boom cylinder	Cylinder type		Double acting piston	
Hydraulic system	Work equipment cylinder – Boom cylinder	Inside diameter of cylinder	mm	ø 75	
Hydraulic system	Work equipment cylinder – Boom cylinder	Outside diameter of piston rod	mm	ø 45	
Hydraulic system	Work equipment cylinder – Boom cylinder	Stroke	mm	552.5	
Hydraulic system	Work equipment cylinder – Boom cylinder	Max. distance between pins	mm	1,450	
Hydraulic system	Work equipment cylinder – Boom cylinder	Min. distance between pins	mm	897.5	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model					PC27MR-2	
					Canopy specification	Cab specification
Serial number					15001 and up	
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 65	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	544	
			Max. distance between pins	mm	1,350	
			Min. distance between pins	mm	806	
		Bucket cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 55	
			Outside diameter of piston rod	mm	ø 35	
			Stroke	mm	460	
			Max. distance between pins	mm	1,190	
			Min. distance between pins	mm	730	
		Boom swing cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 75	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	500	
			Max. distance between pins	mm	1,272	
			Min. distance between pins	mm	772	
		Blade cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 85	
			Outside diameter of piston rod	mm	ø 45	
			Stroke	mm	135	
			Max. distance between pins	mm	561	
			Min. distance between pins	mm	426	

Machine model				PC30MR-2	
				Canopy specification	Cab specification
Serial number				20001 and up	
Bucket capacity			m^3	0.09	0.09
Operating weight			kg	3,180 <2,990> [3,100]	3,355 <3,165> [3,275]
Performance	Working ranges	Max. digging depth	mm	2,910	2,910
		Max. vertical wall depth	mm	2,650	2,650
		Max. digging reach	mm	5,150	5,150
		Max. reach at ground level	mm	5,060	5,060
		Max. digging height	mm	4,950	4,950
		Max. dumping height	mm	3,450	3,450
		Bucket offset	mm	585 (L.H.), 845 (R.H.)	585 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360	360
		Max. blade lowering depth	mm	310	310
	Max. digging force (bucket)		kN {kg}	29.5 {3,000}	29.5 {3,000}
	Continuous swing speed		rpm	9.3	9.3
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.6 (Lo) / 4.6 (Hi)	2.6 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm^2}	29.4 {0.30} <27.4 {0.28}> [28.4 {0.29}]	31.4 {0.32} <29.4 {0.30}> [30.4 {0.31}]
Dimensions	Overall length (for transport)		mm	4,630	4,630
	Overall width		mm	1,550	1,550
	Overall height (for transport)		mm	2,530 [2,525]	2,530 [2,525]
	Ground clearance of conterweight		mm	545 [540]	545 [540]
	Min. ground clearance		mm	320 [320]	320 [320]
	Tail swing radius		mm	855 <775>	885 <885>
	Min. swing radius of work equipment (at boom swing)		mm	2,010 (1,510)	2,010 (1,510)
	Height of work equipment at min. swing radius		mm	3,680	3,680
	Overall width of crawler		mm	1,550	1,550
	Overall length of crawler		mm	2,105	2,105
	Distance between tumbler centers		mm	1,650	1,650
	Track gauge		mm	1,250	1,250
	Machine cab height		mm	1,380	1,380
	Blade width x height		mm	1,550 x 355	1,550 x 355

★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model					PC30MR-2 Canopy specification	PC30MR-2 Cab specification
Serial number					20001 and up	
Engine			Model		3D84E-5N	
Engine			Type		4-cycle, water cooled, in-line direct injection type	
Engine			No. of cylinders – bore x stroke	mm	3 – 84 x 90	
Engine			Piston displacement	ℓ {cc}	1.496 {1,496}	
Engine	Performance		Flywheel horsepower	kW/rpm {HP/rpm}	20.6 / 2,500 {27.6 / 2,500}	
Engine	Performance		Maximum torque	Nm/rpm {kgm/rpm}	94.6 / 1,500 {9.6 / 1,500}	
Engine	Performance		High idle speed	rpm	2,700	
Engine	Performance		Low idle speed	rpm	1,250	
Engine	Performance		Min. fuel consumption ratio	g/kWh {g/HPh}	238 {177}	
Engine			Starting motor		12V, 2.0kW	
Engine			Alternator		12V, 40A	
Engine			Battery (*1)		12V, 58Ah x 1 (90D26L)	
Engine			Radiator • Core type		CF34-1	
Under-carriage			Carrier roller		1 on each side	
Under-carriage			Track roller		4 on each side	
Under-carriage			Track shoe (Rubber shoe)		Unit-type rubber crawler	
Under-carriage			Track shoe (Steel shoe)		Assembly-type double grouser: 44 each side	
Hydraulic system	Hydraulic pump		Type x no.		Variable displacement piston type x 1, gear type x 1	
Hydraulic system	Hydraulic pump		Theoretical capacity	cm^3/rev	30 + 8.5	
Hydraulic system	Hydraulic pump		Set pressure For travel, work equipment For swing For blade	 MPa {kg/cm^2} MPa {kg/cm^2} MPa {kg/cm^2}	 26.0 {265} 19.1 {195} 21.6 {220}	
Hydraulic system	Control valve		Type x no.		9-spool type x 1	
Hydraulic system	Control valve		Control method		Hydraulic assist type	
Hydraulic system	Hydraulic motor		Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2	
Hydraulic system	Hydraulic motor		Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1	
Hydraulic system			Hydraulic tank		Box-shaped, open type	
Hydraulic system			Hydraulic oil filter		Tank return side	
Hydraulic system			Hydraulic oil cooler		Air cooled (Drawn-CUP)	
Hydraulic system	Work equipment cylinder	Boom cylinder	Cylinder type		Double acting piston	
Hydraulic system	Work equipment cylinder	Boom cylinder	Inside diameter of cylinder	mm	ø 80	
Hydraulic system	Work equipment cylinder	Boom cylinder	Outside diameter of piston rod	mm	ø 45	
Hydraulic system	Work equipment cylinder	Boom cylinder	Stroke	mm	550	
Hydraulic system	Work equipment cylinder	Boom cylinder	Max. distance between pins	mm	1,450	
Hydraulic system	Work equipment cylinder	Boom cylinder	Min. distance between pins	mm	900	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model					PC30MR-2 Canopy specification	PC30MR-2 Cab specification
Serial number					20001 and up	
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 75	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	495	
			Max. distance between pins	mm	1,275	
			Min. distance between pins	mm	780	
		Bucket cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 65	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	490	
			Max. distance between pins	mm	1,270	
			Min. distance between pins	mm	780	
		Boom swing cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 80	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	500	
			Max. distance between pins	mm	1,272	
			Min. distance between pins	mm	772	
		Blade cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 85	
			Outside diameter of piston rod	mm	ø 45	
			Stroke	mm	135	
			Max. distance between pins	mm	561	
			Min. distance between pins	mm	426	

Machine model				PC35MR-2	
				Canopy specification	Cab specification
Serial number				5001 and up	
Bucket capacity			m^3	0.11	0.11
Operating weight			kg	3,740 <3,580> [3,690]	3,915 <3,755> [3,865]
Performance	Working ranges	Max. digging depth	mm	3,170	3,170
		Max. vertical wall depth	mm	2,720	2,720
		Max. digging reach	mm	5,360	5,360
		Max. reach at ground level	mm	5,225	5,225
		Max. digging height	mm	5,010	5,010
		Max. dumping height	mm	3,530	3,530
		Bucket offset	mm	585 (L.H.), 845 (R.H.)	585 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360	360
		Max. blade lowering depth	mm	390	390
	Max. digging force (bucket)		kN {kg}	29.9 {3,050}	29.9 {3,050}
	Continuous swing speed		rpm	9.0	9.0
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.8 (Lo) / 4.6 (Hi)	2.8 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm^2}	34.3 {0.35} <33.3 {0.34}> [34.3 {0.35}]	36.3 {0.37} <34.3 {0.35}> [35.3 {0.36}]
Dimensions	Overall length (for transport)		mm	4,850	4,850
	Overall width		mm	1,740	1,740
	Overall height (for transport)		mm	2,530 [2,525]	2,530 [2,525]
	Ground clearance of conterweight		mm	545 [540]	545 [540]
	Min. ground clearance		mm	290 [285]	290 [285]
	Tail swing radius		mm	950 <870>	950 <885>
	Min. swing radius of work equipment (at boom swing)		mm	2,080 (1,590)	2,080 (1,590)
	Height of work equipment at min. swing radius		mm	3,955	3,955
	Overall width of crawler		mm	1,740	1,740
	Overall length of crawler		mm	2,105	2,105
	Distance between tumbler centers		mm	1,650	1,650
	Track gauge		mm	1,440	1,440
	Machine cab height		mm	1,380	1,380
	Blade width x height		mm	1,740 x 355	1,740 x 355

★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model				PC35MR-2 Canopy specification	PC35MR-2 Cab specification
Serial number				5001 and up	
Engine		Model		3D88E-5P	
Engine		Type		4-cycle, water cooled, in-line direct injection type	
Engine		No. of cylinders – bore x stroke	mm	3 – 88 x 90	
Engine		Piston displacement	ℓ {cc}	1.642 {1,642}	
Engine	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	21.7 / 2,400 {29.0 / 2,400}	
Engine	Performance	Maximum torque	Nm/rpm {kgm/rpm}	105.1 / 1,440 {10.7/ 1,440 }	
Engine	Performance	High idle speed	rpm	2,590	
Engine	Performance	Low idle speed	rpm	1,250	
Engine	Performance	Min. fuel consumption ratio	g/kWh {g/HPh}	238 {177}	
Engine		Starting motor		12V, 2.0kW	
Engine		Alternator		12V, 40A	
Engine		Battery (*1)		12V, 58Ah x 1 (90D26L)	
Engine		Radiator • Core type		CF34-1	
Under-carriage		Carrier roller		1 on each side	
Under-carriage		Track roller		4 on each side	
Under-carriage		Track shoe (Rubber shoe)		Unit-type rubber crawler	
Under-carriage		Track shoe (Steel shoe)		Assembly-type double grouser: 44 each side	
Hydraulic system	Hydraulic pump	Type x no.		Variable displacement piston type x 1, gear type x 2	
Hydraulic system	Hydraulic pump	Theoretical capacity	cm^3/rev	16.5 x 2 + 8.5 + 4.5	
Hydraulic system	Hydraulic pump	Set pressure For travel, work equipment For swing For blade	 MPa {kg/cm^2} MPa {kg/cm^2} MPa {kg/cm^2}	 26.0 {265} 19.1 {195} 21.6 {220}	
Hydraulic system	Control valve	Type x no.		9-spool type x 1	
Hydraulic system	Control valve	Control method		Hydraulic assist type	
Hydraulic system	Hydraulic motor	Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2	
Hydraulic system	Hydraulic motor	Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1	
Hydraulic system		Hydraulic tank		Box-shaped, open type	
Hydraulic system		Hydraulic oil filter		Tank return side	
Hydraulic system		Hydraulic oil cooler		Air cooled (Drawn-CUP)	
Hydraulic system	Work equipment cylinder – Boom cylinder	Cylinder type		Double acting piston	
Hydraulic system	Work equipment cylinder – Boom cylinder	Inside diameter of cylinder	mm	ø 80	
Hydraulic system	Work equipment cylinder – Boom cylinder	Outside diameter of piston rod	mm	ø 45	
Hydraulic system	Work equipment cylinder – Boom cylinder	Stroke	mm	585	
Hydraulic system	Work equipment cylinder – Boom cylinder	Max. distance between pins	mm	1,530	
Hydraulic system	Work equipment cylinder – Boom cylinder	Min. distance between pins	mm	945	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model					PC35MR-2 Canopy specification	PC35MR-2 Cab specification
Serial number					5001 and up	
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 75	
			Outside diameter of piston rod	mm	ø 45	
			Stroke	mm	595	
			Max. distance between pins	mm	1,510	
			Min. distance between pins	mm	915	
		Bucket cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 65	
			Outside diameter of piston rod	mm	ø 40	
			Stroke	mm	490	
			Max. distance between pins	mm	1,270	
			Min. distance between pins	mm	780	
		Boom swing cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 95	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	482	
			Max. distance between pins	mm	1,283	
			Min. distance between pins	mm	801	
		Blade cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 95	
			Outside diameter of piston rod	mm	ø 45	
			Stroke	mm	140	
			Max. distance between pins	mm	610	
			Min. distance between pins	mm	470	

Machine model				PC35MR-2 (High altitude spec.) Cab specification
Serial number				6736 and up
Bucket capacity			m^3	0.11
Operating weight			kg	3,930 <3,770> [3,880]
Performance	Working ranges	Max. digging depth	mm	3,170
		Max. vertical wall depth	mm	2,720
		Max. digging reach	mm	5,360
		Max. reach at ground level	mm	5,225
		Max. digging height	mm	5,010
		Max. dumping height	mm	3,530
		Bucket offset	mm	585 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360
		Max. blade lowering depth	mm	390
	Max. digging force (bucket)		kN {kg}	29.9 {3,050}
	Continuous swing speed		rpm	9.0
	Swing max. slope angle		deg.	19.0
	Travel speed		km/h	2.8 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30
	Ground pressure		kPa {kg/cm^2}	36.3{0.37} <34.3{0.35}> [35.3{0.36}]
Dimensions	Overall length (for transport)		mm	4,850
	Overall width		mm	1,740
	Overall height (for transport)		mm	2,530 [2,525]
	Ground clearance of conterweight		mm	545 [540]
	Min. ground clearance		mm	290 [285]
	Tail swing radius		mm	950 <885>
	Min. swing radius of work equipment (at boom swing)		mm	2,080 (1,590)
	Height of work equipment at min. swing radius		mm	3,955
	Overall width of crawler		mm	1,740
	Overall length of crawler		mm	2,105
	Distance between tumbler centers		mm	1,650
	Track gauge		mm	1,440
	Machine cab height		mm	1,380
	Blade width x height		mm	1,740 x 355

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★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model				PC35MR-2 (High altitude spec.) Cab specification
Serial number				6736 and up
Engine		Model		S3D84E-5PBA
		Type		4-cycle, water cooled, in-line direct injection type
		No. of cylinders – bore x stroke	mm	3 – 84 x 90
		Piston displacement	ℓ {cc}	1.496 {1,496}
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	23.9 / 2,400 {32.1 / 2,400}
		Maximum torque	Nm/rpm {kgm/rpm}	118.4 / 1,700 {12.1/ 1,700 }
		High idle speed	rpm	2,590
		Low idle speed	rpm	1,250
		Min. fuel consumption ratio	g/kWh {g/HPh}	242 {178}
		Starting motor		12V, 2.0kW
		Alternator		12V, 40A
		Battery (*1)		12V, 58Ah x 1 (90D26L)
		Radiator • Core type		CF34-1
Under-carriage		Carrier roller		1 on each side
		Track roller		4 on each side
		Track shoe (Rubber shoe)		Unit-type rubber crawler
		Track shoe (Steel shoe)		Assembly-type double grouser: 44 each side
Hydraulic system	Hydraulic pump	Type x no.		Variable displacement piston type x 1, gear type x 2
		Theoretical capacity	cm^3/rev	16.5 x 2 + 8.5 + 4.5
		Set pressure		
		For travel, work equipment	MPa {kg/cm^2}	26.0 {265}
		For swing	MPa {kg/cm^2}	19.1 {195}
		For blade	MPa {kg/cm^2}	21.6 {220}
	Control valve	Type x no.		9-spool type x 1
		Control method		Hydraulic assist type
	Hydraulic motor	Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2
		Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1
		Hydraulic tank		Box-shaped, open type
		Hydraulic oil filter		Tank return side
		Hydraulic oil cooler		Air cooled (Drawn-CUP)
	Work equipment cylinder – Boom cylinder	Cylinder type		Double acting piston
		Inside diameter of cylinder	mm	ø 80
		Outside diameter of piston rod	mm	ø 45
		Stroke	mm	585
		Max. distance between pins	mm	1,530
		Min. distance between pins	mm	945

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model					PC35MR-2 (High altitude spec.) Cab specification
Serial number					6736 and up
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston
			Inside diameter of cylinder	mm	ø 75
			Outside diameter of piston rod	mm	ø 45
			Stroke	mm	595
			Max. distance between pins	mm	1,510
			Min. distance between pins	mm	915
		Bucket cylinder	Cylinder type		Double acting piston
			Inside diameter of cylinder	mm	ø 65
			Outside diameter of piston rod	mm	ø 40
			Stroke	mm	490
			Max. distance between pins	mm	1,270
			Min. distance between pins	mm	780
		Boom swing cylinder	Cylinder type		Double acting piston
			Inside diameter of cylinder	mm	ø 95
			Outside diameter of piston rod	mm	ø 50
			Stroke	mm	482
			Max. distance between pins	mm	1,283
			Min. distance between pins	mm	801
		Blade cylinder	Cylinder type		Double acting piston
			Inside diameter of cylinder	mm	ø 95
			Outside diameter of piston rod	mm	ø 45
			Stroke	mm	140
			Max. distance between pins	mm	610
			Min. distance between pins	mm	470

Machine model				PC40MR-2	
				Canopy specification	Cab specification
Serial number				8001 and up	
Bucket capacity			m³	0.14	0.14
Operating weight			kg	4,790 <4,540> [4,605]	4,940 <4,690> [4,755]
Performance	Working ranges	Max. digging depth	mm	3,500	3,500
		Max. vertical wall depth	mm	2,770	2,770
		Max. digging reach	mm	5,870	5,870
		Max. reach at ground level	mm	5,710	5,710
		Max. digging height	mm	5,570	5,570
		Max. dumping height	mm	3,860	3,860
		Bucket offset	mm	630 (L.H.), 880 (R.H.)	630 (L.H.), 880 (R.H.)
		Max. blade lifting height	mm	430	430
		Max. blade lowering depth	mm	330	330
	Max. digging force (bucket)		kN {kg}	33.9 {3,460}	33.9 {3,460}
	Continuous swing speed		rpm	9.0	9.0
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.8 (Lo) / 4.6 (Hi)	2.8 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm²}	26.5 {0.27} <25.5 {0.26}> [25.5 {0.26}]	27.4 {0.28} <26.5 {0.27}> [26.5 {0.27}]
Dimensions	Overall length (for transport)		mm	5,390	5,390
	Overall width		mm	1,960	1,960
	Overall height (for transport)		mm	2,625 [2,620]	2,625 [2,620]
	Ground clearance of conterweight		mm	630 [625]	630 [625]
	Min. ground clearance		mm	320 [315]	320 [315]
	Tail swing radius		mm	1,060 <980>	1,060 <980>
	Min. swing radius of work equipment (at boom swing)		mm	2,270 (1,740)	2,270 (1,740)
	Height of work equipment at min. swing radius		mm	4,250	4,250
	Overall width of crawler		mm	1,960	1,960
	Overall length of crawler		mm	2,520 [2,500]	2,520 [2,500]
	Distance between tumbler centers		mm	2,000 [1,980]	2,000 [1,980]
	Track gauge		mm	1,560	1,560
	Machine cab height		mm	1,590 [1,585]	1,590 [1,585]
	Blade width x height		mm	1,960 x 355	1,960 x 355

★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model					PC40MR-2 Canopy specification	PC40MR-2 Cab specification
Serial number					8001 and up	
Engine			Model		4D88E-5X	
Engine			Type		4-cycle, water cooled, in-line direct injection type	
Engine			No. of cylinders – bore x stroke	mm	4 – 88 x 90	
Engine			Piston displacement	ℓ {cc}	2.189 {2,189}	
Engine	Performance		Flywheel horsepower	kW/rpm {HP/rpm}	29.4 / 2,350 {39.4/ 2,350}	
Engine	Performance		Maxium torque	Nm/rpm {kgm/rpm}	139 / 1,440 {14.2 / 1,440}	
Engine	Performance		High idle speed	rpm	2,500	
Engine	Performance		Low idle speed	rpm	1,175	
Engine	Performance		Min. fuel consumption ratio	g/kWh {g/HPh}	252 {188}	
Engine			Starting motor		12V, 2.3kW	
Engine			Alternator		12V, 40A	
Engine			Battery (*1)		12V, 72Ah x 1 (115D31L)	
Engine			Radiator • Core type		Corrugated aluminum	
Under-carriage			Carrier roller		1 on each side	
Under-carriage			Track roller		4 on each side	
Under-carriage			Track shoe (Rubber shoe)		Unit-type rubber crawler	
Under-carriage			Track shoe (Steel shoe)		Triple grouser: 39 each side	
Hydraulic system	Hydraulic pump		Type x no.		Variable displacement piston type x 1, gear type x 2	
Hydraulic system	Hydraulic pump		Theoretical capacity	cm^3/rev	22.3 x 2 + 14.1 + 5.2	
Hydraulic system	Hydraulic pump		Set pressure For travel, work equipment For swing For blade	 MPa {kg/cm^2} MPa {kg/cm^2} MPa {kg/cm^2}	 26.5 {270} 19.6 {200} 21.6 {220}	
Hydraulic system	Control valve		Type x no.		9-spool type x 1	
Hydraulic system	Control valve		Control method		Hydraulic assist type	
Hydraulic system	Hydraulic motor		Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2	
Hydraulic system	Hydraulic motor		Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1	
Hydraulic system			Hydraulic tank		Box-shaped, open type	
Hydraulic system			Hydraulic oil filter		Tank return side	
Hydraulic system			Hydraulic oil cooler		Air cooled (Revised louver fin CF42)	
Hydraulic system	Work equipment cylinder	Boom cylinder	Cylinder type		Double acting piston	
Hydraulic system	Work equipment cylinder	Boom cylinder	Inside diameter of cylinder	mm	ø 90	
Hydraulic system	Work equipment cylinder	Boom cylinder	Outside diameter of piston rod	mm	ø 50	
Hydraulic system	Work equipment cylinder	Boom cylinder	Stroke	mm	697	
Hydraulic system	Work equipment cylinder	Boom cylinder	Max. distance between pins	mm	1,740	
Hydraulic system	Work equipment cylinder	Boom cylinder	Min. distance between pins	mm	1,043	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model					PC40MR-2	
					Canopy specification	Cab specification
Serial number					8001 and up	
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 80	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	650	
			Max. distance between pins	mm	1,631.5	
			Min. distance between pins	mm	981.5	
		Bucket cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 70	
			Outside diameter of piston rod	mm	ø 45	
			Stroke	mm	580	
			Max. distance between pins	mm	1,480	
			Min. distance between pins	mm	900	
		Boom swing cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 95	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	630	
			Max. distance between pins	mm	1,572	
			Min. distance between pins	mm	942	
		Blade cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 110	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	140	
			Max. distance between pins	mm	643.5	
			Min. distance between pins	mm	503.5	

Machine model				PC50MR-2	
				Canopy specification	Cab specification
Serial number				5001 and up	
Bucket capacity			m³	0.16	0.16
Operating weight			kg	5,040 <4,790> [4,855]	5,190 <4,940> [5,005]
Performance	Working ranges	Max. digging depth	mm	3,800	3,800
		Max. vertical wall depth	mm	3,020	3,020
		Max. digging reach	mm	6,220	6,220
		Max. reach at ground level	mm	6,070	6,070
		Max. digging height	mm	5,945	5,945
		Max. dumping height	mm	4,230	4,230
		Bucket offset	mm	630 (L.H.), 880 (R.H.)	630 (L.H.), 880 (R.H.)
		Max. blade lifting height	mm	430	430
		Max. blade lowering depth	mm	330	330
	Max. digging force (bucket)		kN {kg}	39.0 {3,980}	39.0 {3,980}
	Continuous swing speed		rpm	9.0	9.0
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.8 (Lo) / 4.6 (Hi)	2.8 (Lo) / 4.6 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm²}	28.4 {0.29} <27.4 {0.28}> [27.4 {0.28}]	29.4 {0.30} <28.4 {0.29}> [28.4 {0.29}]
Dimensions	Overall length (for transport)		mm	5,550	5,550
	Overall width		mm	1,960	1,960
	Overall height (for transport)		mm	2,625 [2,620]	2,625 [2,620]
	Ground clearance of conterweight		mm	630 [625]	630 [625]
	Min. ground clearance		mm	320 [315]	320 [315]
	Tail swing radius		mm	1,060 <980>	1,060 <980>
	Min. swing radius of work equipment (at boom swing)		mm	2,270 (1,740)	2,270 (1,740)
	Height of work equipment at min. swing radius		mm	4,475	4,475
	Overall width of crawler		mm	1,960	1,960
	Overall length of crawler		mm	2,520 [2,500]	2,520 [2,500]
	Distance between tumbler centers		mm	2,000 [1,980]	2,000 [1,980]
	Track gauge		mm	1,560	1,560
	Machine cab height		mm	1,590 [1,585]	1,590 [1,585]
	Blade width x height		mm	1,960 x 355	1,960 x 355

★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
★ Values in < > are for the X-weightless specifications.
★ Values in [ ] are for the X-weightless and steel shoe specification.

Machine model				PC50MR-2	
				Canopy specification	Cab specification
Serial number				5001 and up	
Engine		Model		4D88E-5X	
		Type		4-cycle, water cooled, in-line direct injection type	
		No. of cylinders – bore x stroke	mm	4 – 88 x 90	
		Piston displacement	ℓ {cc}	2.189 {2,189}	
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	29.4/ 2,350 {39.4 / 2,350}	
		Maximum torque	Nm/rpm {kgm/rpm}	139 / 1,440 {14.2 / 1,440}	
		High idle speed	rpm	2,500	
		Low idle speed	rpm	1,175	
		Min. fuel consumption ratio	g/kWh {g/HPh}	252 {188}	
		Starting motor		12V, 2.3kW	
		Alternator		12V, 40A	
		Battery (*1)		12V, 72Ah x 1 (115D31L)	
		Radiator • Core type		Corrugated aluminum	
Under-carriage		Carrier roller		1 on each side	
		Track roller		4 on each side	
		Track shoe (Rubber shoe)		Unit-type rubber crawler	
		Track shoe (Steel shoe)		Triple grouser: 39 each side	
Hydraulic system	Hydraulic pump	Type x no.		Variable displacement piston type x 1, gear type x 2	
		Theoretical capacity	cm^3/rev	22.3 x 2 + 14.1 + 5.2	
		Set pressure For travel, work equipment For swing For blade	MPa {kg/cm^2} MPa {kg/cm^2} MPa {kg/cm^2}	26.5 {270} 19.6 {200} 21.6 {220}	
	Control valve	Type x no.		9-spool type x 1	
		Control method		Hydraulic assist type	
	Hydraulic motor	Travel motor		Variable-displacement piston motor (with counterval-ance valve, parking brake) x 2	
		Swing motor		Fixed-displacement piston motor (with brake valve, swing shaft brake) x 1	
		Hydraulic tank		Box-shaped, open type	
		Hydraulic oil filter		Tank return side	
		Hydraulic oil cooler		Air cooled (Revised louver fin CF42)	
	Work equipment cylinder – Boom cylinder	Cylinder type		Double acting piston	
		Inside diameter of cylinder	mm	ø 90	
		Outside diameter of piston rod	mm	ø 50	
		Stroke	mm	697	
		Max. distance between pins	mm	1,740	
		Min. distance between pins	mm	1,043	

*1: The battery capacity (Ah) is based on 5-hour rate.

					PC50MR-2	
Machine model					Canopy specification	Cab specification
Serial number					5001 and up	
Hydraulic system	Work equipment cylinder	Arm cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 85	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	734	
			Max. distance between pins	mm	1,804	
			Min. distance between pins	mm	1,070	
		Bucket cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 75	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	580	
			Max. distance between pins	mm	1,480	
			Min. distance between pins	mm	900	
		Boom swing cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 95	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	630	
			Max. distance between pins	mm	1,572	
			Min. distance between pins	mm	942	
		Blade cylinder	Cylinder type		Double acting piston	
			Inside diameter of cylinder	mm	ø 110	
			Outside diameter of piston rod	mm	ø 50	
			Stroke	mm	140	
			Max. distance between pins	mm	643.5	
			Min. distance between pins	mm	503.5	

WEIGHT TABLE

⚠ This weight table is a guide for use when transporting or handing components.

Unit: kg

Machine model	PC27MR-2		PC30MR-2	
	Canopy specification	Cab specification	Canopy specification	Cab specification
Serial number	15001 and up		20001 and up	
Engine assembly (without oil, water)	182	182	210	210
• Engine	135	135	163	163
• Engine mount	7	7	7	7
• PTO	10	10	10	10
• Hydraulic pump	30	30	30	30
Cooling assembly (excluding coolant and oil)	22	22	21	21
Battery	19	19	19	19
Revolving frame	311	311	361	361
Floor frame	125	—	125	—
Canopy assembly	118	—	118	—
Handrail	6	—	6	—
Operator's cab (with floor frame)	—	356	—	356
Operator's seat	12	12	12	12
Fuel tank (without fuel)	5	5	5	5
Hydraulic tank (without hydraulic oil)	35	35	35	35
Control valve	36	36	36	36
Counterweight	300	300	360	360
X-weight (Additional counterweight)	190	190	190	190
Swing motor (with brake valve)	14	14	14	14
Swing machinery	19	19	19	19
Track frame assembly (without track shoe)	572	572	673	673
• Track frame	278	278	373	373
• Idler assembly	26 x 2	26 x 2	26 x 2	26 x 2
• Recoil spring assembly	14 x 2	14 x 2	14 x 2	14 x 2
• Carrier roller assembly	4 x 2	4 x 2	4 x 2	4 x 2
• Track roller assembly	6 x 8	6 x 8	6 x 8	6 x 8
• Travel motor (with reduction gear)	37 x 2	37 x 2	37 x 2	37 x 2
• Sprocket	10 x 2	10 x 2	10 x 2	10 x 2
• Swing circle	37	37	37	37
• Center swivel joint	9	9	15	15

Unit: kg

PC35MR-2		PC35MR-2 (High altitude spec.)	PC40MR-2		PC50MR-2	
Canopy specification	Cab specification	Cab specification	Canopy specification	Cab specification	Canopy specification	Cab specification
5001 and up		6736 and up	8001 and up		5001 and up	
212	212	227	254	254	254	254
164	164	179	205	205	205	205
7	7	7	12	12	12	12
10	10	10	8	8	8	8
31	31	31	29	29	29	29
21	21	21	32	32	32	32
19	19	19	24	24	24	24
384	384	384	561	561	561	561
125	—	—	125	—	125	—
118	—	—	127	—	127	—
6	—	—	6	—	6	—
—	356	356	—	356	—	356
12	12	12	12	12	12	12
5	5	5	31	31	31	31
35	35	35	35	35	35	35
45	45	45	45	45	45	45
621	621	621	567	567	716	716
160	160	160	250	250	250	250
14	14	14	15	15	15	15
19	19	19	26	26	26	26
705	705	705	950	950	950	950
403	403	403	539	539	539	539
26 x 2	26 x 2	26 x 2	46 x 2	46 x 2	46 x 2	46 x 2
14 x 2	14 x 2	14 x 2	16 x 2	16 x 2	16 x 2	16 x 2
4 x 2	4 x 2	4 x 2	3 x 2	3 x 2	3 x 2	3 x 2
6 x 8	6 x 8	6 x 8	10 x 8	10 x 8	10 x 8	10 x 8
37 x 2	37 x 2	37 x 2	50 x 2	50 x 2	50 x 2	50 x 2
10 x 2	10 x 2	10 x 2	12 x 2	12 x 2	12 x 2	12 x 2
37	37	37	59	59	59	59
15	15	15	18	18	18	18

Unit: kg

Machine model	PC27MR-2		PC30MR-2	
	Canopy specification	Cab specification	Canopy specification	Cab specification
Serial number	15001 and up		20001 and up	
Track shoe assembly				
• Rubber shoe (300 mm)	114 x 2	114 x 2	123 x 2	123 x 2
(400 mm)	—	—	—	—
• Double grouser shoe (300 mm)	156 x 2	156 x 2	170 x 2	170 x 2
(400 mm)	—	—	—	—
• Road liner (300 mm)	175 x 2	175 x 2	188 x 2	188 x 2
(400 mm)	—	—	—	—
Boom swing bracket assembly	60	60	60	60
Boom assembly	95	95	98	98
Arm assembly	43	43	50	50
Bucket link assembly	17	17	18	18
Bucket assembly (with side cutter)	55	55	64	64
Blade assembly	140	140	158	158
Boom cylinder assembly	25	25	28	28
Arm cylinder assembly	19	19	22	22
Bucket cylinder assembly	13	13	18	18
Boom swing cylinder assembly	21	21	22	22
Blade cylinder assembly	16	16	16	16

Unit: kg

PC35MR-2		PC35MR-2 (High altitude spec.)	PC40MR-2		PC50MR-2	
Canopy specification	Cab specification	Cab specification	Canopy specification	Cab specification	Canopy specification	Cab specification
5001 and up		6736 and up	8001 and up		5001 and up	
123 x 2 — 170 x 2 — 188 x 2 —	123 x 2 — 170 x 2 — 188 x 2 —	123 x 2 — 170 x 2 — 188 x 2 —	— 242 x 2 — 274 x 2 — 285 x 2	— 242 x 2 — 274 x 2 — 285 x 2	— 242 x 2 — 274 x 2 — 285 x 2	— 242 x 2 — 274 x 2 — 285 x 2
70	70	70	101	101	101	101
116	116	116	160	160	169	169
58	58	58	70	70	84	84
18	18	18	28	28	28	28
76	76	76	105	105	121	121
167	167	167	216	216	216	216
29	29	29	41	41	41	41
26	26	26	36	36	40	40
18	18	18	25	25	29	29
34	34	34	35	35	39	39
20	20	20	31	31	31	31

LUBRICANTS, FUEL AND COOLANT SPECIFICATIONS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104 122°F -30 -20 -10 0 10 20 30 40 50°C	CAPACITY (ℓ) Specified	Refill
Engine oil pan	Engine oil	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40	PC30, 35MR: 7.7 PC40, 50MR: 8.0	PC30, 35MR: 7.2 PC40, 50MR: 7.4
Final drive case (each)	Engine oil	SAE 30	PC30, 35MR: 0.6 PC40, 50MR: 0.8	PC30, 35MR: 0.6 PC40, 50MR: 0.8
Hydraulic system	Engine oil	SAE 10W SAE 10W-30 SAE 15W-40	PC30MR: 40 PC35MR: 45 PC40, 50MR: 55	PC30MR: 20 PC35MR: 20 PC40, 50MR: 20
Fuel tank	Diesel fuel	ASTM D975 No.2 * 1	PC30, 35MR: 44 PC40, 50MR: 65	—
Grease fiting	Grease	HYPER WHITE GREASE	—	—
Cooling system	Coolant	Add antifreeze	PC30, 35MR: 3.3 PC40, 50MR: 7.3	—

* 1 : ASTM D975 No.1

NOTICE
Use only diesel fuel.
The engine mounted on this machine employs a high-pressure fuel injection device to obtain good fuel consumption and good exhaust gas characteristics. For this reason, It requires high precision for the parts and good lubrication.
If kerosene or other fuel with low lubricating ability is used, there will be a big drop in durability.

REMARK

- When fuel sulphur content is less than 0.5%, change oil in the oil pan according to the periodic maintenance hours described in this manual.
  Charge oil according to the following table if fuel sulphur content is above 0.5%.

- When starting the engine with an atmospheric temperature of lower than 0°C (32°F), be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though the atmospheric temperature goes up to 10°C (50°F) more or less during the day.

- Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.

- There is no problem if single grade oil is mixed with multigrade oil (SAE10W-30, 15W-40), but be sure to add single grade oil that matches the temperature range in the table.

- We recommend Komatsu genuine oil which has been specifically formulated and approved for use in engine and hydraulic work equipment applications.

Specified capacity: Total amount of oil including oil for components and oil in piping.

Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

ASTM: American Society of Testing and Material
SAE: Society of Automotive Engineers
API: American Petroleum Institute

Fuel sulphur content	Charge interval of oil in engine oil pan
0.5 to 1.0 %	1/2 of regular interval
Above 1.0 %	1/4 of regular interval

10 STRUCTURE, FUNCTION AND MAINTENANCE STANDARD

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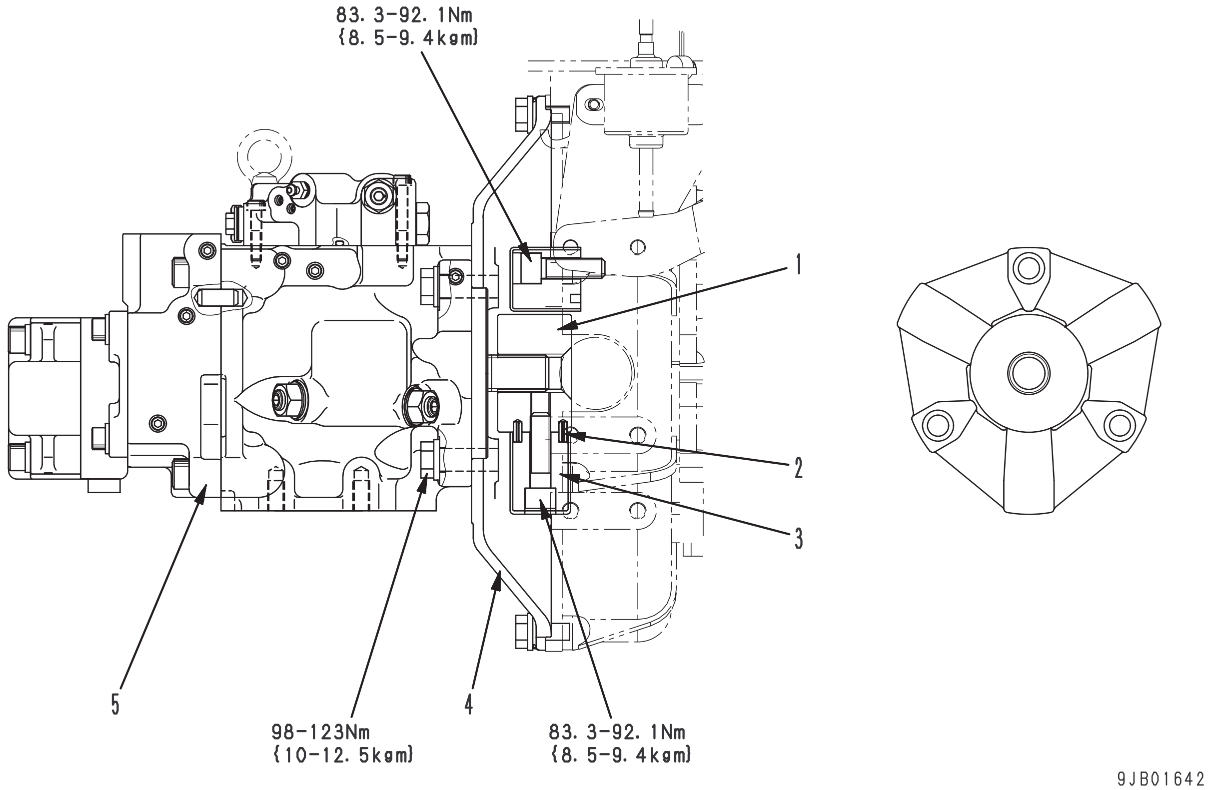
PTO

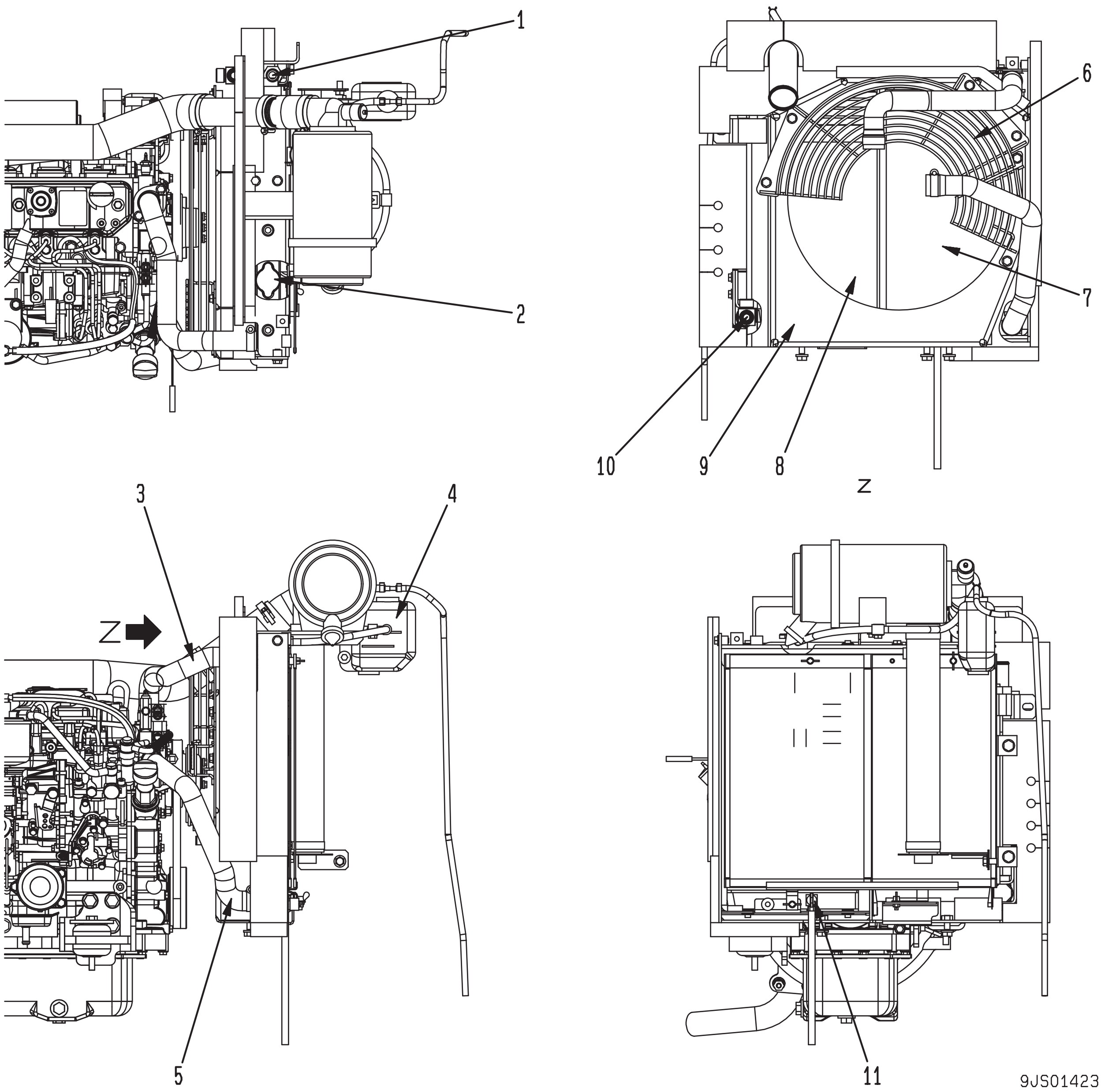
★ This diagram shows PC27MR, 30MR, 35MR.



1. Boss
2. Spring pin
3. Rubber
4. Cover
5. Hydraulic pump

COOLING SYSTEM

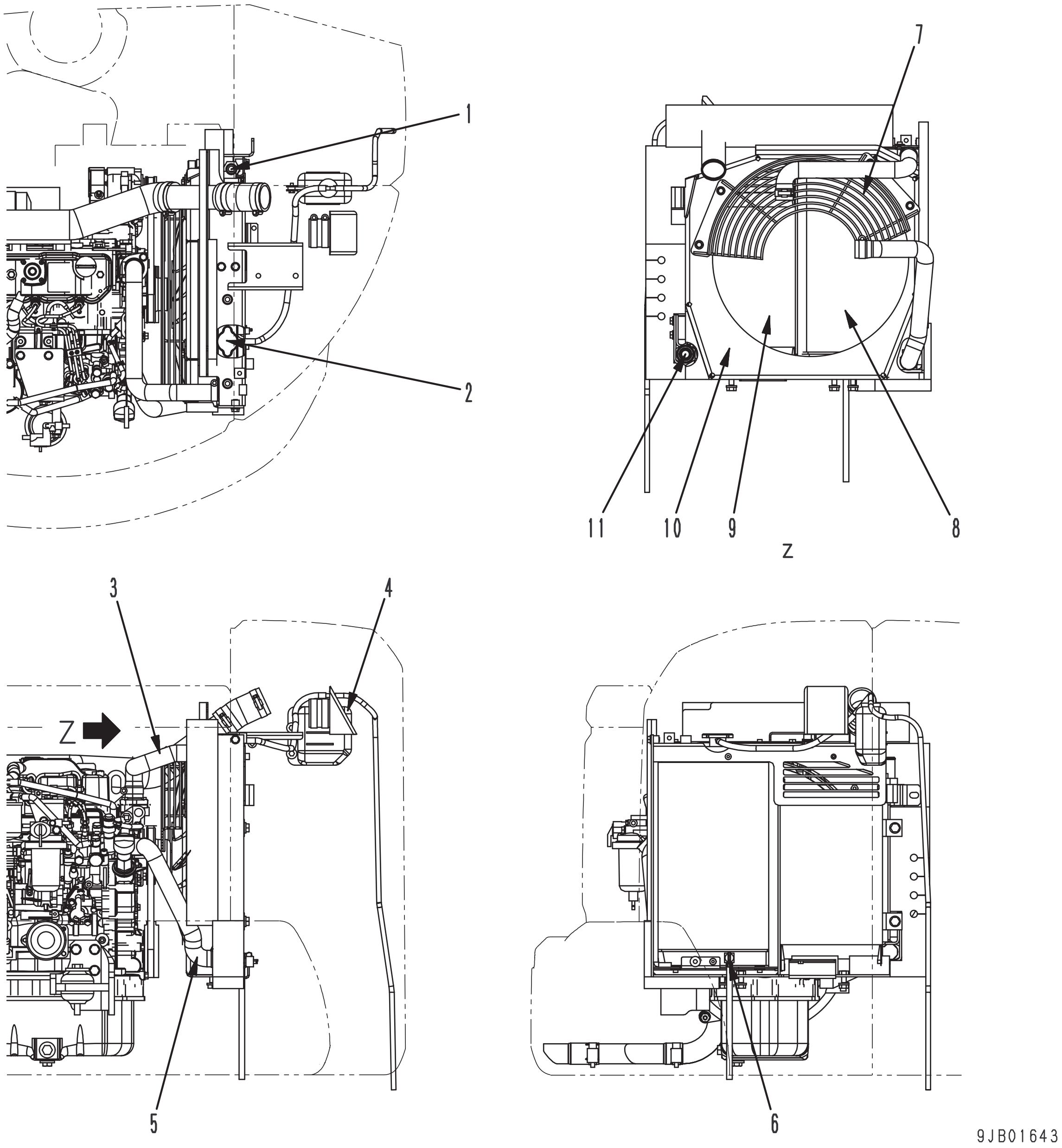
PC27MR-2



1. Oil cooler outlet
2. Radiator cap
3. Radiator inlet hose
4. Reservoir tank
5. Radiator outlet hose
6. Fan guard
7. Radiator
8. Oil cooler
9. Shroud
10. Oil cooler inlet
11. Drain valve

PC30MR, 35MR, 40MR, 50MR-2

★ This diagram shows PC30MR, 35MR.



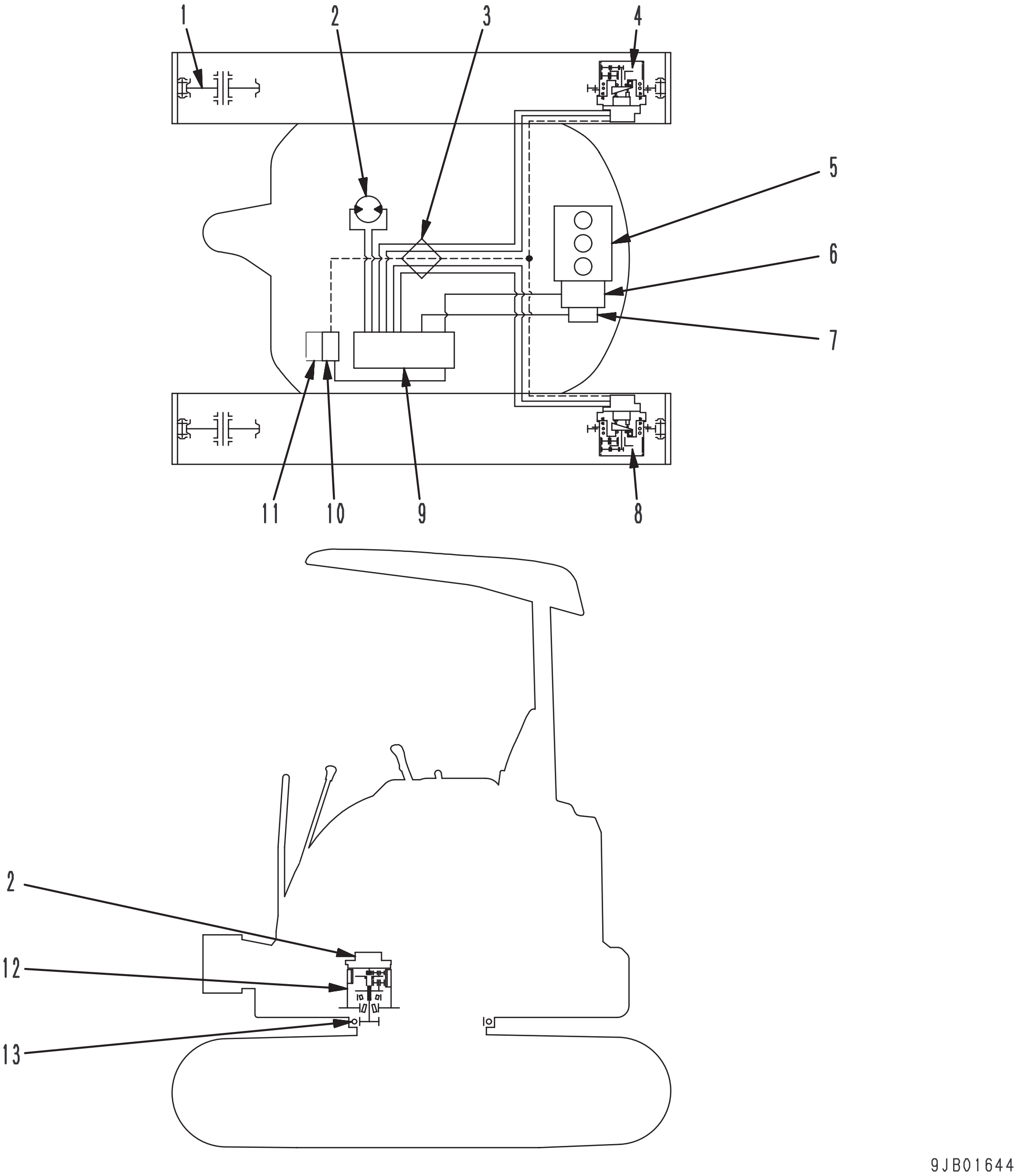
1. Oil cooler outlet
2. Radiator cap
3. Radiator inlet hose
4. Reservoir tank
5. Radiator outlet hose
6. Drain valve
7. Fan guard
8. Radiator
9. Oil cooler
10. Shroud
11. Oil cooler inlet

SPECIFICATIONS

	Radiator		Oil cooler	
	PC27MR-2 PC30MR-2 PC35MR-2	PC40MR-2 PC50MR-2	PC27MR-2 PC30MR-2 PC35MR-2	PC40MR-2 PC50MR-2
Core type	CF34-1	Corrugated aluminum	Drawn-cup	Revised louver fin CF42
Fan pitch (mm)	3.0 / 2	3.5 / 2	4.0 / 2	4.0 / 2
Total heat dissipation surface (m^2)	3.12	13.61	2.63	5.36
Pressure valve cracking pressure (kPa {kg/cm^2})	88.3 ± 14.7 {0.9 ± 0.15}	49.0 ± 14.7 {0.5 ± 0.15}	—	—
Vacuum valve cracking pressure (kPa {kg/cm^2})	4.9 {0.05}	0 – 4.9 {0 – 0.05}	—	—

POWER TRAIN

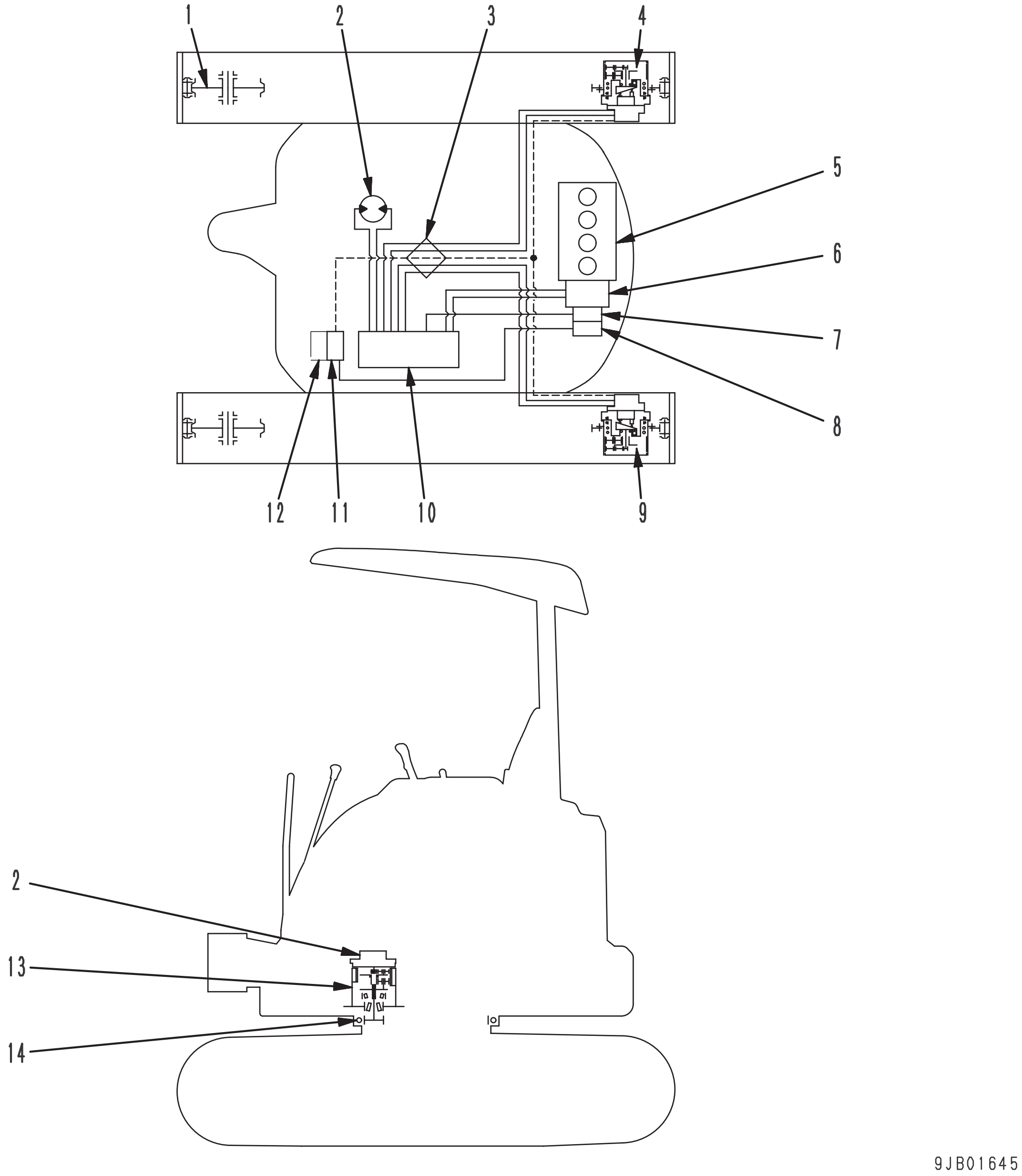
PC27MR, 30MR-2



1. Idler
2. Swing motor
3. Center swivel joint
4. Right travel motor
5. Engine
6. Hydraulic pump (For work equipment and travel)
7. Hydraulic pump (For swing and blade)
8. Left travel motor
9. Control valve
10. Travel Hi-Lo speed selector valve
11. PPC lock solenoid valve
12. Swing machinery
13. Swing circle

PC35MR, 40MR, 50MR-2

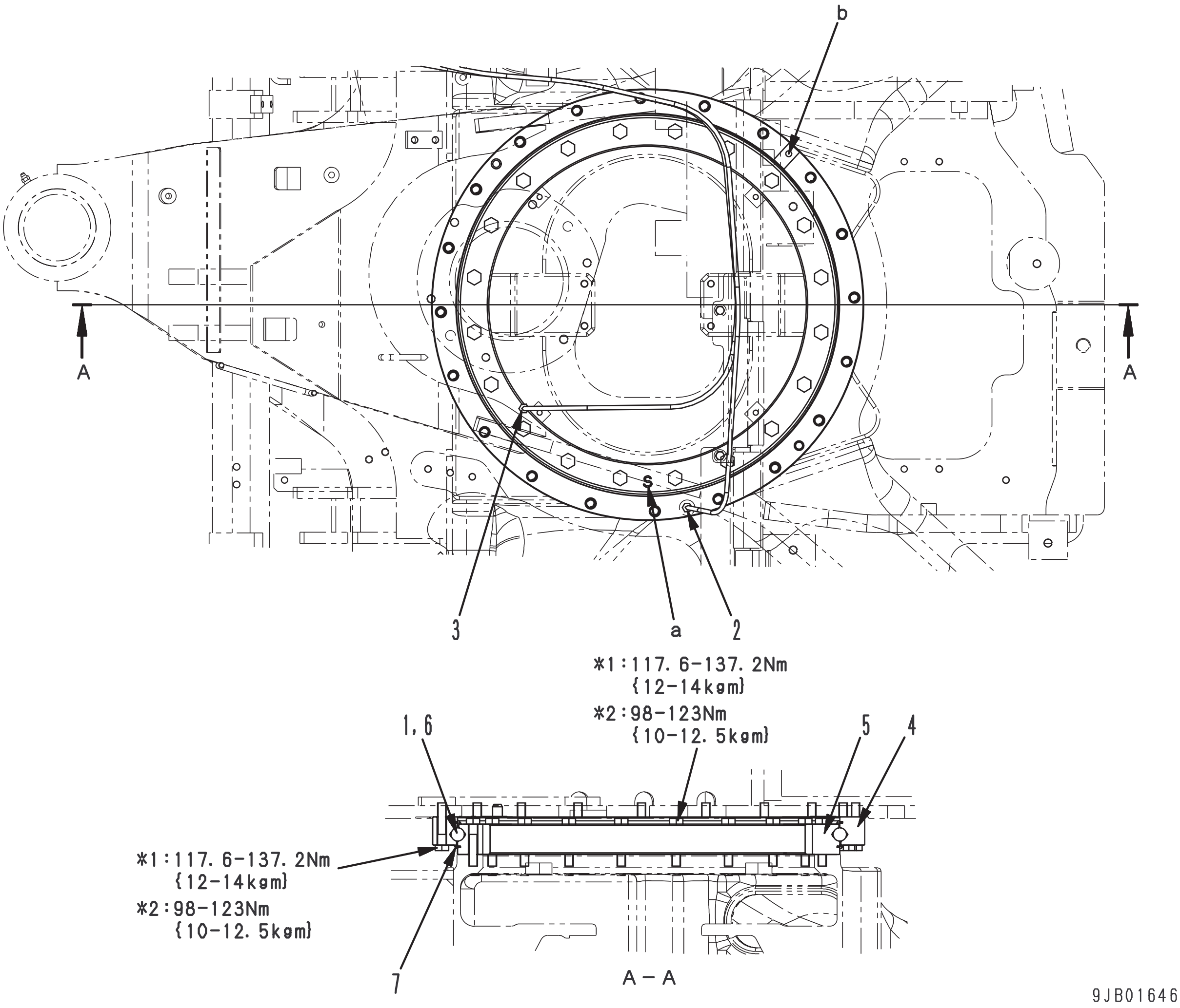
★ This diagram shows PC40MR, 50MR.



1. Idler
2. Swing motor
3. Center swivel joint
4. Right travel motor
5. Engine
6. Hydraulic pump (For work equipment and travel)
7. Hydraulic pump (For swing and blade)
8. Hydraulic pump (For pilot)
9. Left travel motor
10. Control valve
11. Travel Hi-Lo speed selector valve
12. PPC lock solenoid valve
13. Swing machinery
14. Swing circle

SWING CIRCLE

★ This diagram shows PC27MR, 30MR, 35MR.



* 1 : PC27MR, 30MR, 35MR-2
* 2 : PC40MR, 50MR-2

Unit: mm

No.	Check item		Criteria		Remedy
1	Clearance between bearing		Standard clearance	Clearance limit	Replace
		PC27MR-2 PC30MR-2 PC35MR-2	0.20 – 0.70	1.4	
		PC40MR-2 PC50MR-2	0.20 – 0.70	1.7	

2. Swing circle bearing lubricator
3. Swing circle pinion lubricator
4. Outer race
5. Inner race
6. Ball
7. Seal

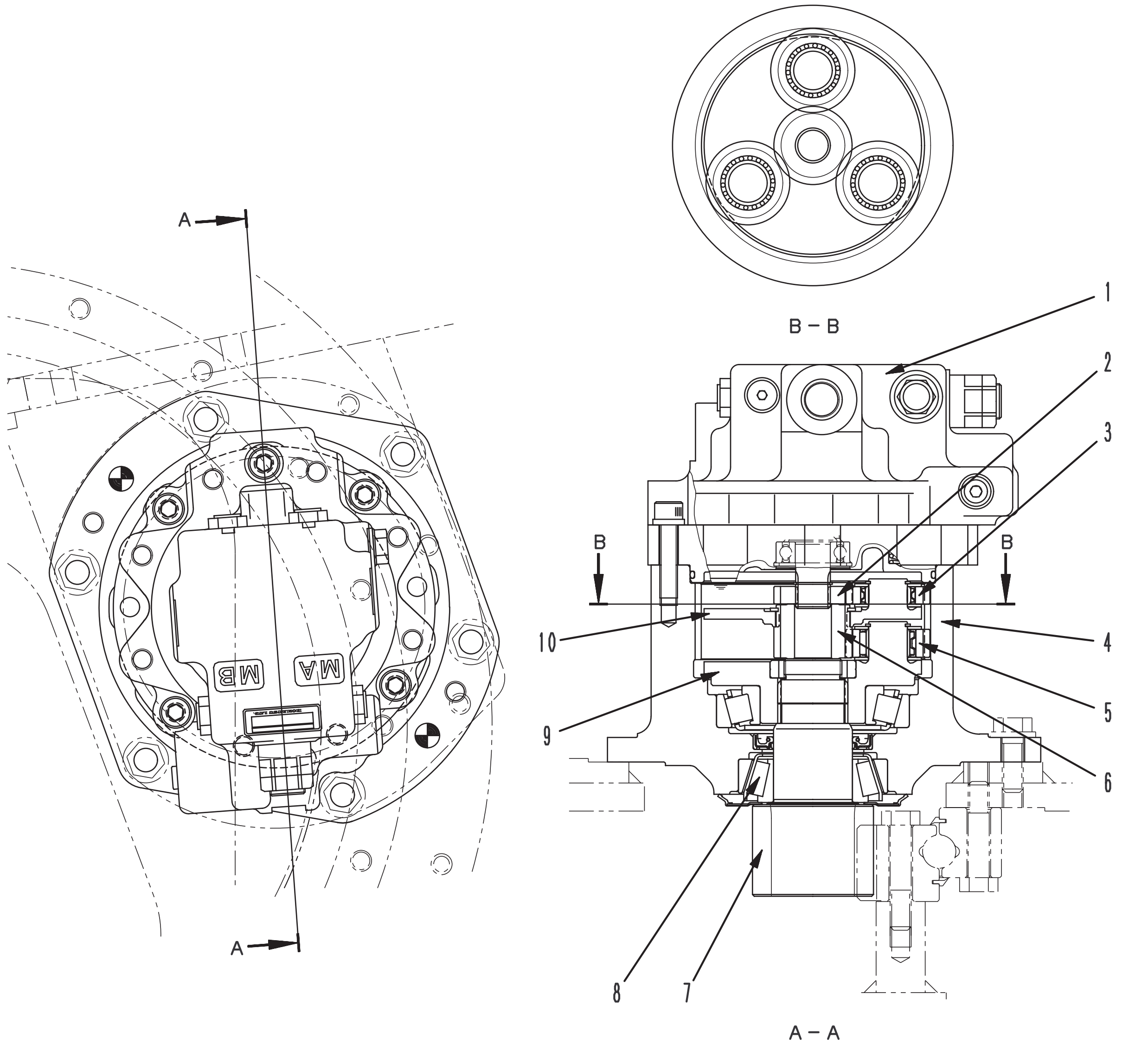
a. Inner race soft zone position
b. Outer race soft zone position

SPECIFICATIONS

Model	PC27MR-2 PC30MR-2 PC35MR-2	PC40MR-2 PC50MR-2
Reduction ratio	92 / 11 = 8.36	90 / 10 = 9.00
Grease	G2-LI	

SWING MACHINERY

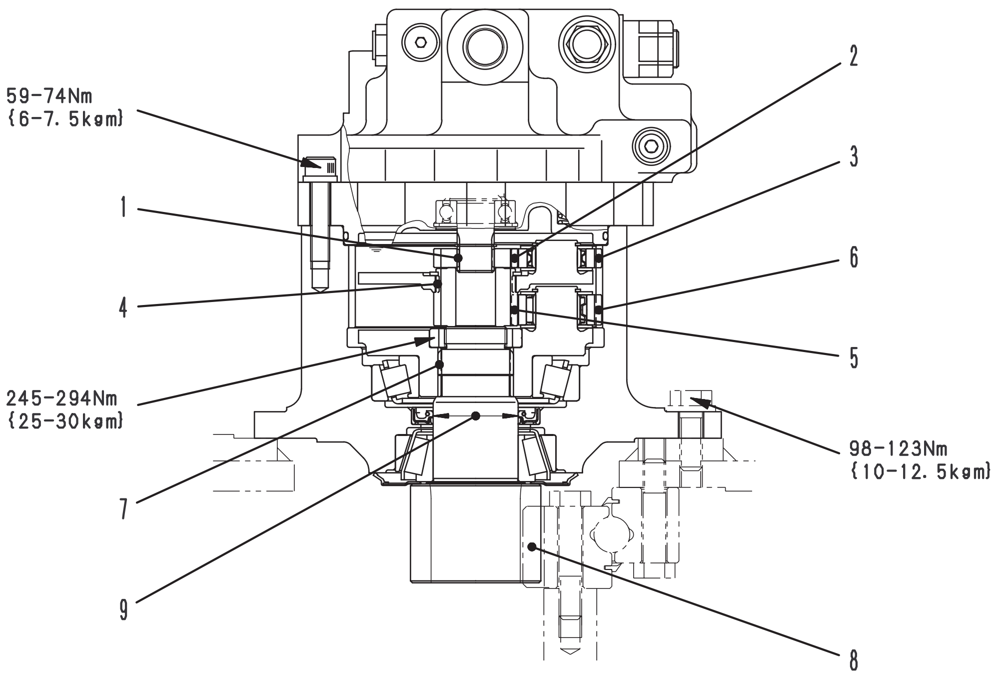
PC27MR, 30MR, 35MR-2



1. Swing motor
2. No.1 sun gear (No. of tooth: 23)
3. No.1 planetary gear (No. of tooth: 25)
4. Swing machinery case (No. of tooth: 73)
5. No. 2 planetary gear (No. of tooth: 25)
6. No.2 sun gear (No. of tooth: 23)
7. Swing pinion (No. of tooth: 11)
8. Taper roller bearing
9. No. 2 planetary carrier
10. No. 1 planetary carrier

SPECIFICATIONS

Reduction ratio	(23+73) / 23 x (23+73) / 23 = 17.42
Swing reduction ratio	17.42 x 8.36 = 145.71
Swing speed (rpm)	9.3
Lubrication oil	SAE10W
Oil amount (ℓ)	0.9



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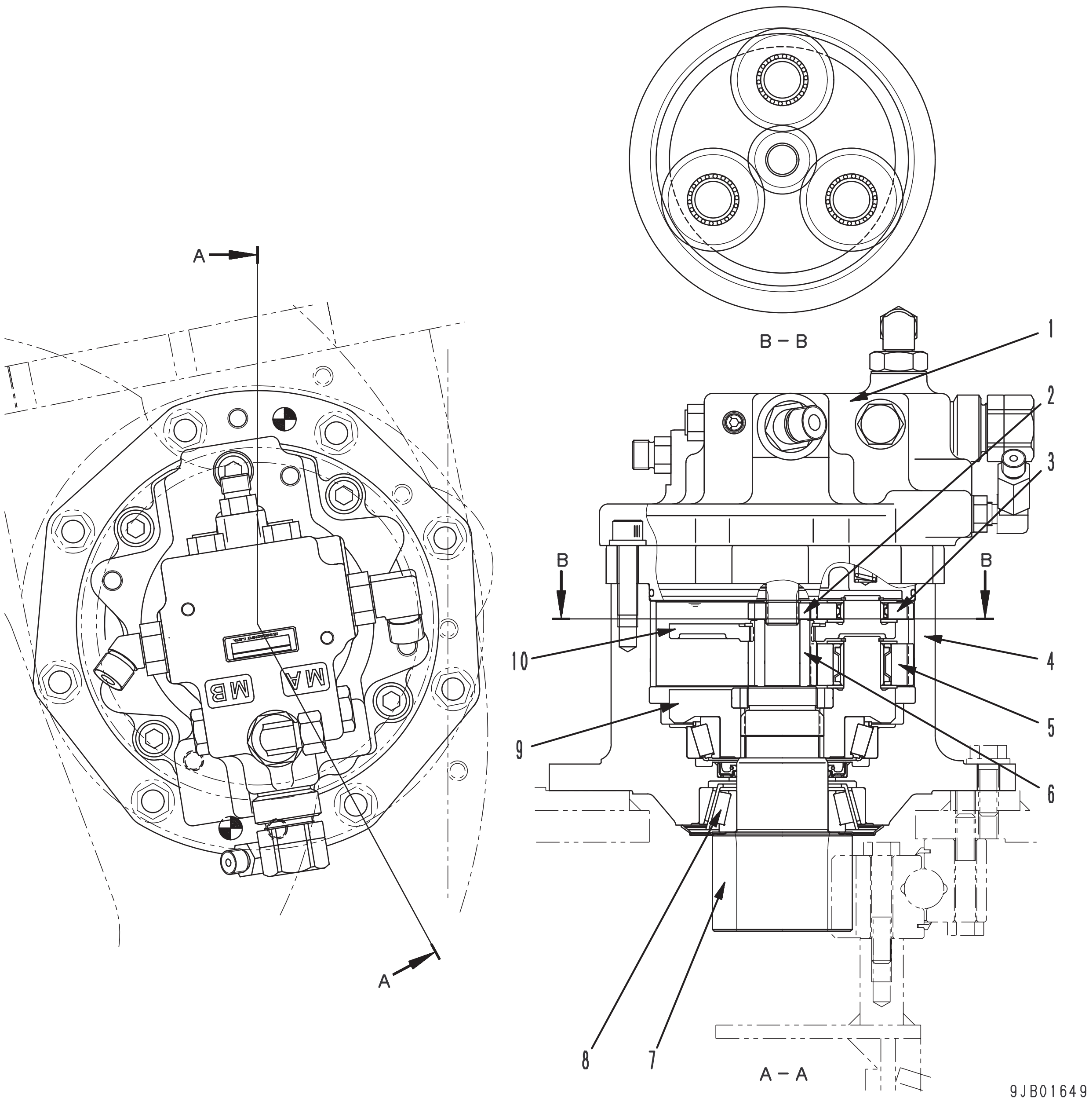
Unit: mm

No.	Check item	Criteria			Remedy
1	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance		Clearance limit	Replace
		0.04 – 0.11		—	
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.09 – 0.25		0.6	
3	Backlash between No. 1 planetary gear and swing machinery case	0.10 – 0.33		0.6	
4	Backlash between No. 1 planetary gear and No. 2 sun gear	0.10 – 0.21		—	
5	Backlash between No. 2 sun gear and No. 2 planetary gear	0.09 – 0.25		0.6	
6	Backlash between No. 2 planetary gear and swing machinery case	0.10 – 0.33		0.6	
7	Backlash between No. 2 planetary carrier and swing pinion	0.016 – 0.097		—	
8	Backlash between swing pinion and swing circle	0.12 – 0.68		2.0	
9	Wear of oil seal sliding surface of swing pinion	Standard size	Tolerance	Repair limit	Repair by hard chromium plating or replace
		45	0 – 0.062	44.8	

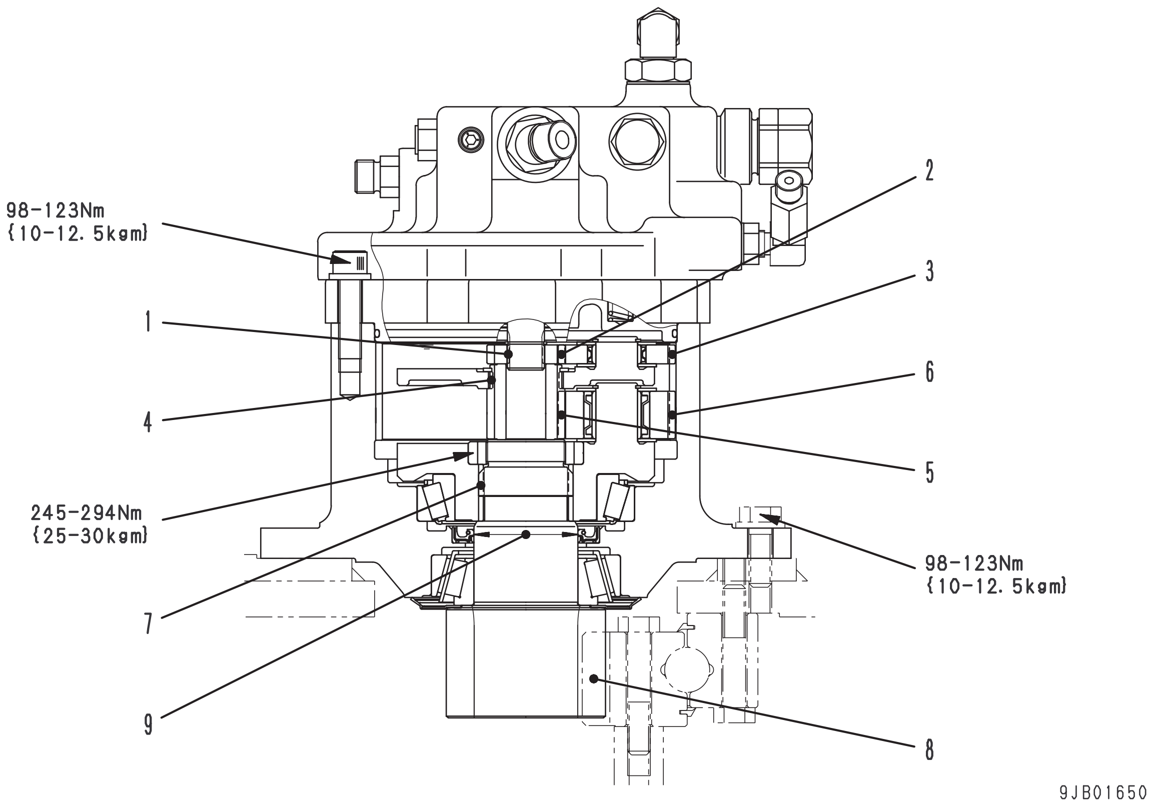
PC40MR, 50MR-2



1. Swing motor
2. No.1 sun gear (No. of tooth: 21)
3. No.1 planetary gear (No. of tooth: 33)
4. Swing machinery case (No. of tooth: 87)
5. No.2 planetary gear (No. of tooth: 33)
6. No.2 sun gear (No. of tooth: 21)
7. Swing pinion (No. of tooth: 10)
8. Taper roller bearing
9. No. 2 planetary carrier
10. No. 1 planetary carrier

SPECIFICATIONS

Reduction ratio	(21+87) / 21 x (21+87) / 21 = 26.45
Swing reduction ratio	26.45 x 9.00 = 238.04
Swing speed (rpm)	9.0
Lubrication oil	SAE10W
Oil amount (ℓ)	1.3

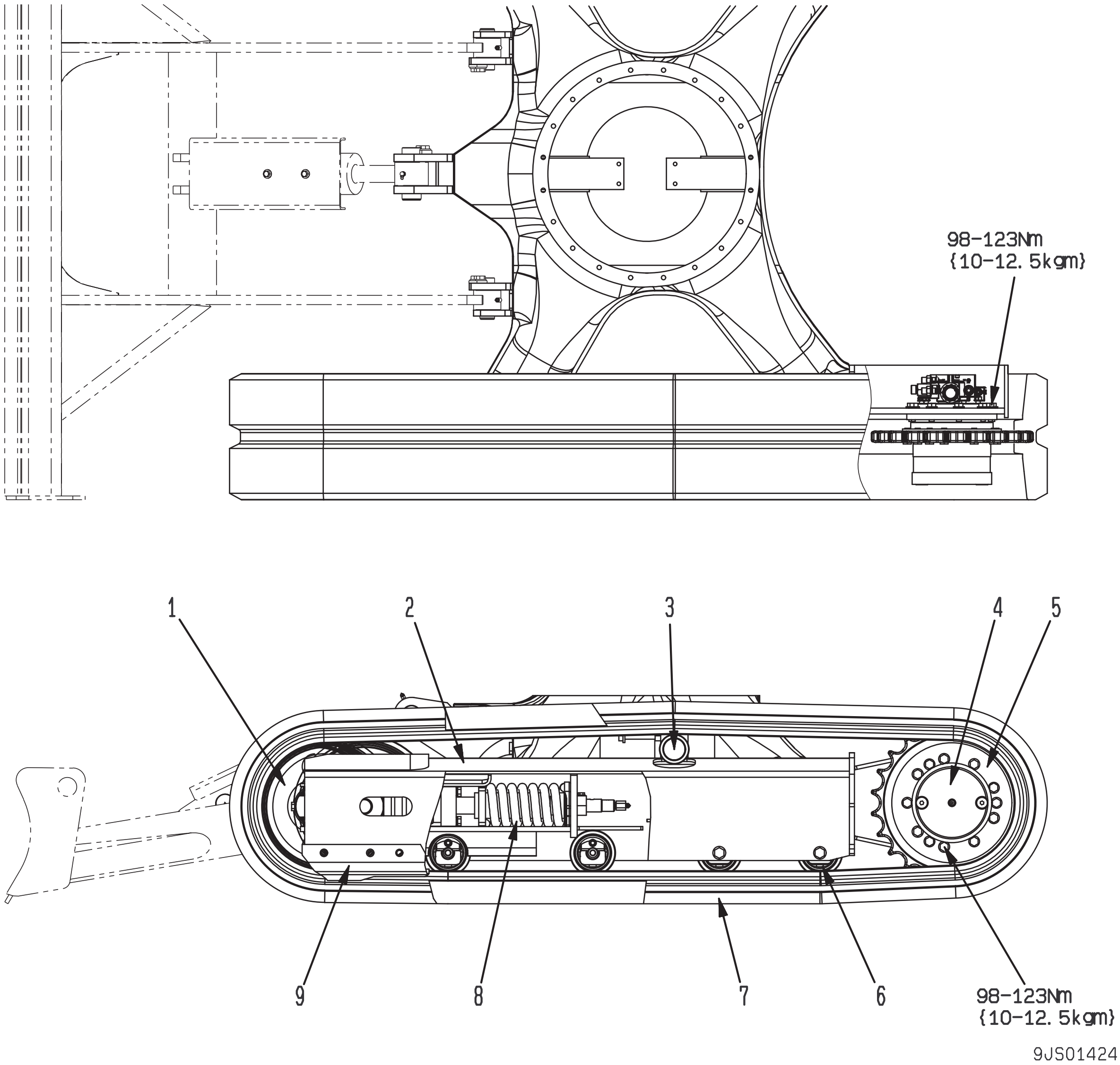


Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="3">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Backlash between swing motor shaft and No. 1 sun gear</td><td>Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="9">Replace</td></tr>
<tr><td>0.04 – 0.11</td><td colspan="2">—</td></tr>
<tr><td>2</td><td>Backlash between No. 1 sun gear and No. 1 planetary gear</td><td>0.12 – 0.28</td><td colspan="2">0.6</td></tr>
<tr><td>3</td><td>Backlash between No. 1 planetary gear and swing machinery case</td><td>0.14 – 0.38</td><td colspan="2">0.6</td></tr>
<tr><td>4</td><td>Backlash between No. 1 planetary gear and No. 2 sun gear</td><td>0.10 – 0.26</td><td colspan="2">—</td></tr>
<tr><td>5</td><td>Backlash between No. 2 sun gear and No. 2 planetary gear</td><td>0.12 – 0.28</td><td colspan="2">0.6</td></tr>
<tr><td>6</td><td>Backlash between No. 2 planetary gear and swing machinery case</td><td>0.14 – 0.38</td><td colspan="2">0.6</td></tr>
<tr><td>7</td><td>Backlash between No. 2 planetary carrier and swing pinion</td><td>0.016 – 0.097</td><td colspan="2">—</td></tr>
<tr><td>8</td><td>Backlash between swing pinion and swing circle</td><td>0.14 – 0.73</td><td colspan="2">2.0</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Wear of oil seal sliding surface of swing pinion</td><td>Standard size</td><td>Tolerance</td><td>Repair limit</td><td rowspan="2">Repair by hard chromium plating or replace</td></tr>
<tr><td>55</td><td>0
– 0.074</td><td>54.8</td></tr>
</table>

TRACK FRAME

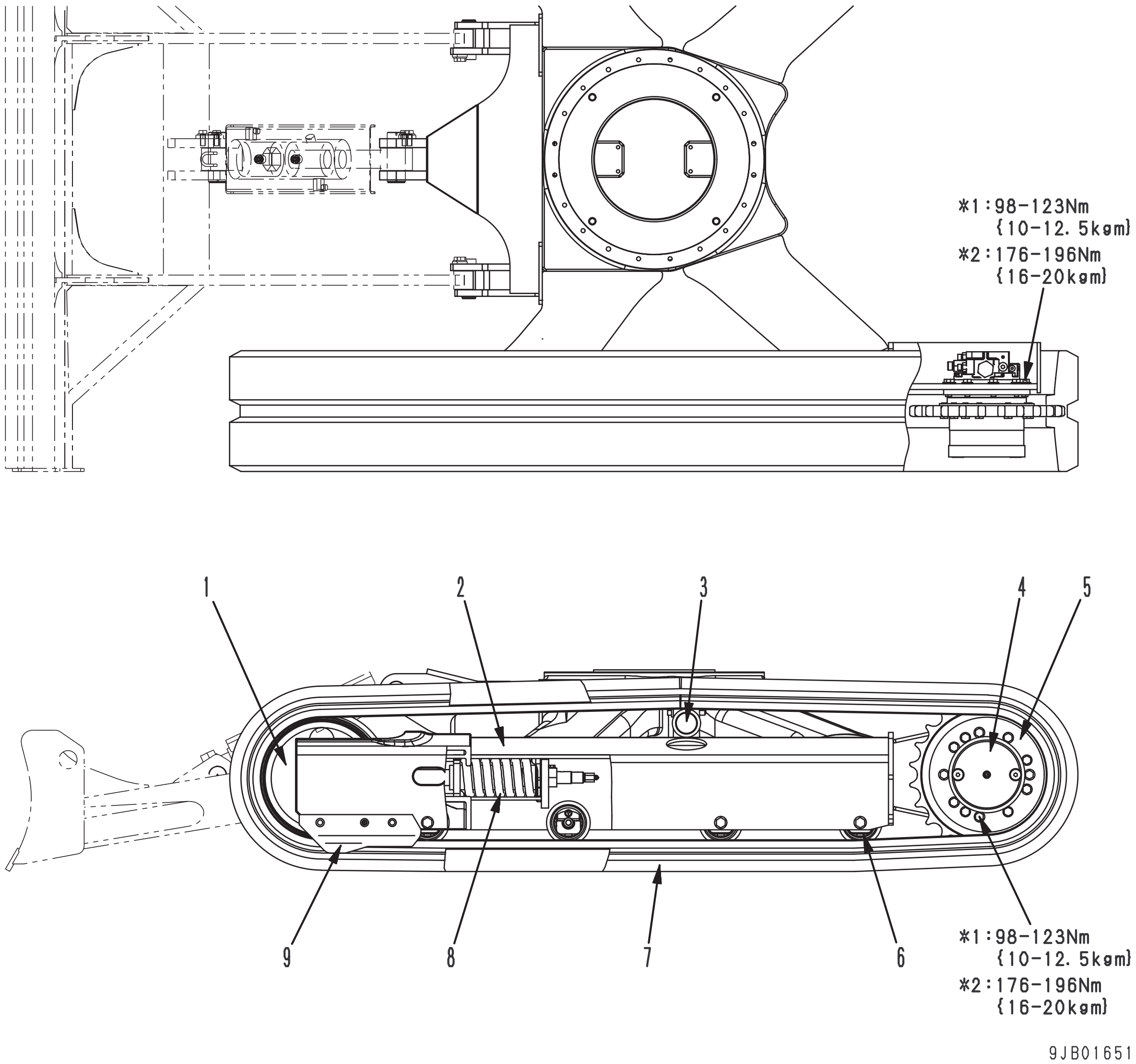
PC27MR-2



1. Idler
2. Track frame
3. Carrier roller
4. Travel motor
5. Sprocket
6. Track roller
7. Track shoe
8. Idler cushion
9. Idler guard
   (Steel shoe and road liner spec.)

PC30MR, 35MR, 40MR, 50MR-2

★ This diagram shows PC30MR, 35MR.

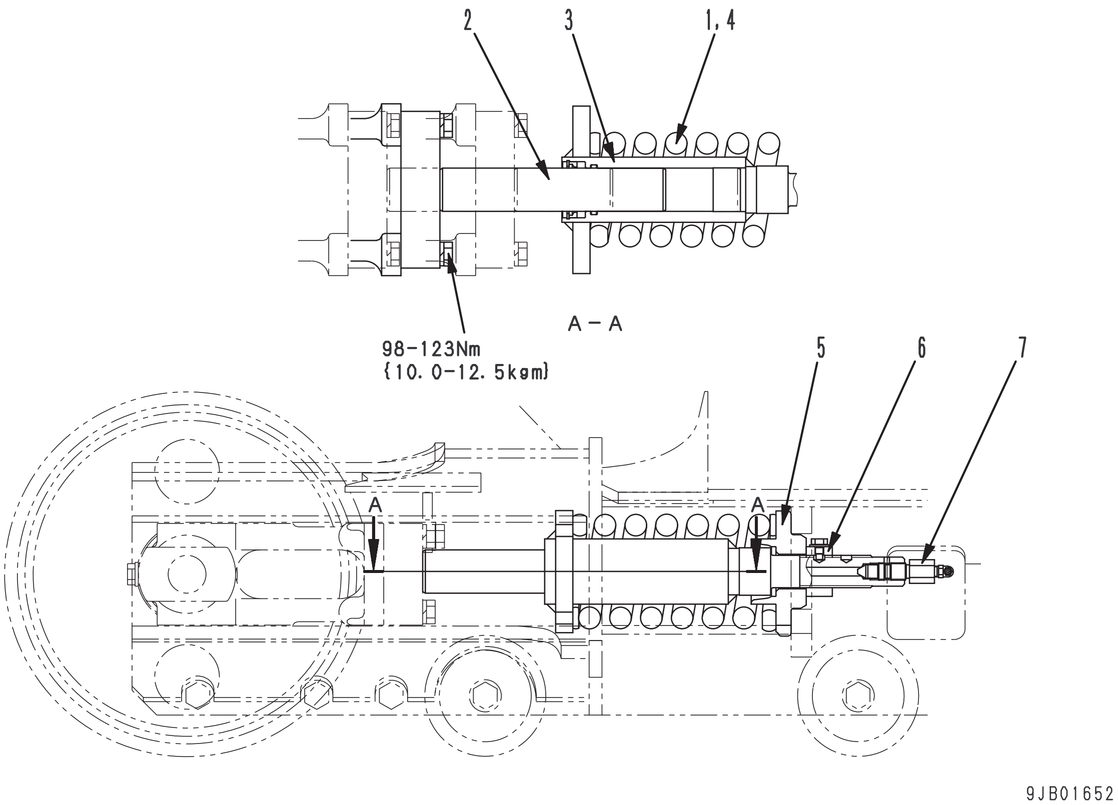


* 1 : PC30MR, 35MR-2
* 2 : PC40MR, 50MR-2

1. Idler
2. Track frame
3. Carrier roller
4. Travel motor
5. Sprocket
6. Track roller
7. Track shoe
8. Idler cushion
9. Idler guard
   (Steel shoe and road liner spec.)

IDLER CUSHION

★ The following figure shows the PC27MR, 30MR and 35MR with the rubber shoe specification.



Unit: mm

No.	Check item		Criteria					Remedy
			Standard size			Repair limit		
			Free length	Installed length	Installed load	Free length	Installed load	
1	Recoil spring (Rubber shoe spec.)	PC27MR-2 PC30MR-2 PC35MR-2	257	188	30.9 kN {3,153 kg}	251	28.5 kN {2,901 kg}	Replace
		PC40MR-2 PC50MR-2	302	202.2	42.4 kN {4,326 kg}	294	39.0 kN {3,980 kg}	
	Recoil spring (Steel shoe spec.) (Road liner spec.)	PC27MR-2 PC30MR-2 PC35MR-2	257	213	19.7 kN {2,012 kg}	251	17.6 kN {1,791 kg}	
		PC40MR-2 PC50MR-2	302	238.2	27.0 kN {2,748 kg}	294	24.0 kN {2,446 kg}	

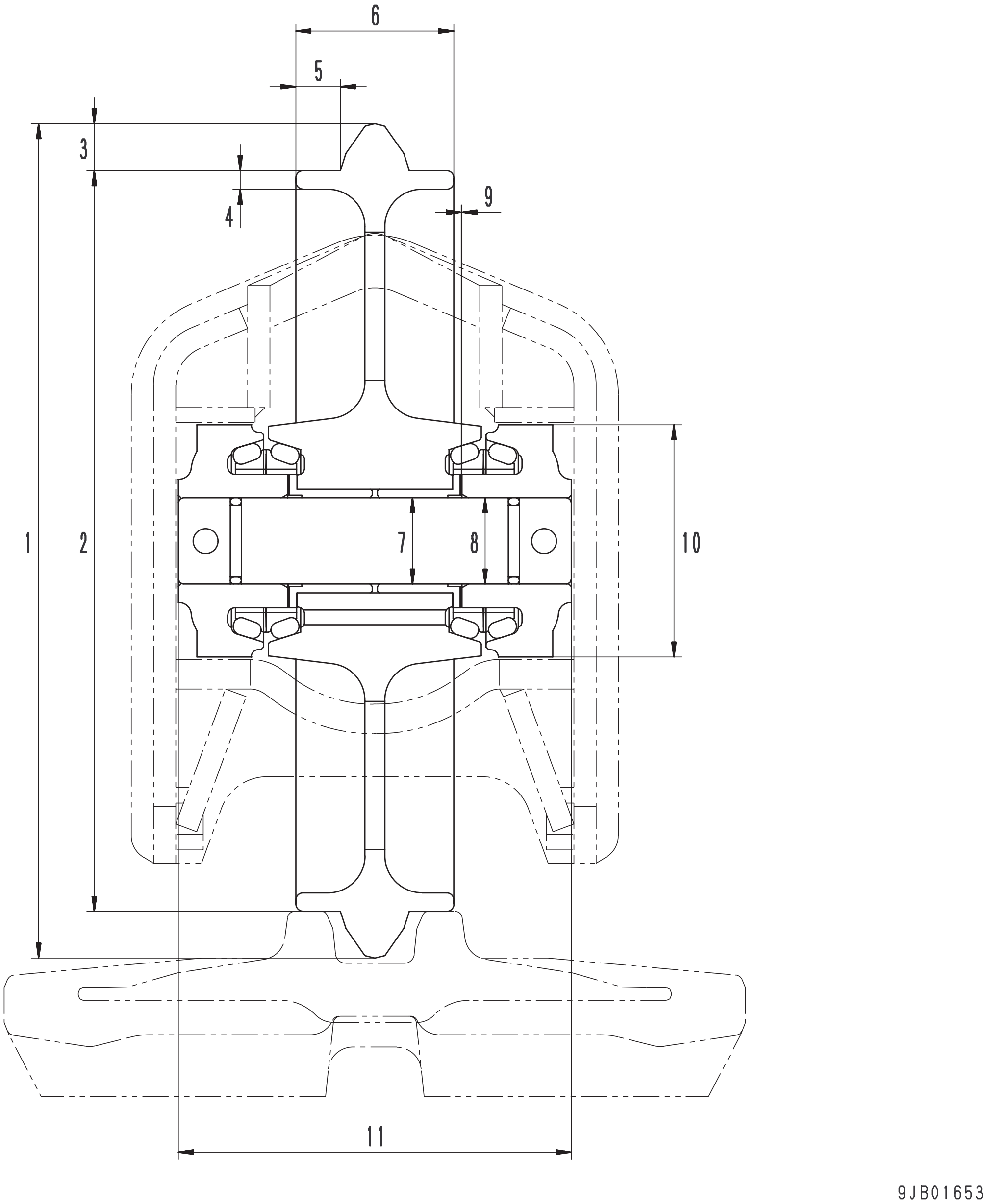
2. Rod
3. Cylinder
4. Recoil spring
5. Rear support
6. Nut
7. Lubricator

SPECIFICATIONS

Grease	G2-LI
Amount of grease	120

IDLER

★ This diagram shows PC27MR, 30MR, 35MR.



Unit: mm

No.	Check item		Criteria: Standard size	Criteria: Repair limit	Remedy
1	Outside diameter of projection	PC27MR-2 PC30MR-2 PC35MR-2	ø 338	—	Repair by overlaying welding or replace
		PC40MR-2 PC50MR-2	ø 377	—	
2	Outside diameter of tread	PC27MR-2 PC30MR-2 PC35MR-2	ø 300	ø 292	
		PC40MR-2 PC50MR-2	ø 335	ø 327	
3	Depth of tread	PC27MR-2 PC30MR-2 PC35MR-2	19	23	
		PC40MR-2 PC50MR-2	21	25	
4	Thickness of tread	PC27MR-2 PC30MR-2 PC35MR-2	8.7	4.7	
		PC40MR-2 PC50MR-2	10.3	6.3	
5	Width of tread	PC27MR-2 PC30MR-2 PC35MR-2	18	22	
		PC40MR-2 PC50MR-2	18	22	
6	Total width	PC27MR-2 PC30MR-2 PC35MR-2	64	—	
		PC40MR-2 PC50MR-2	75	—	

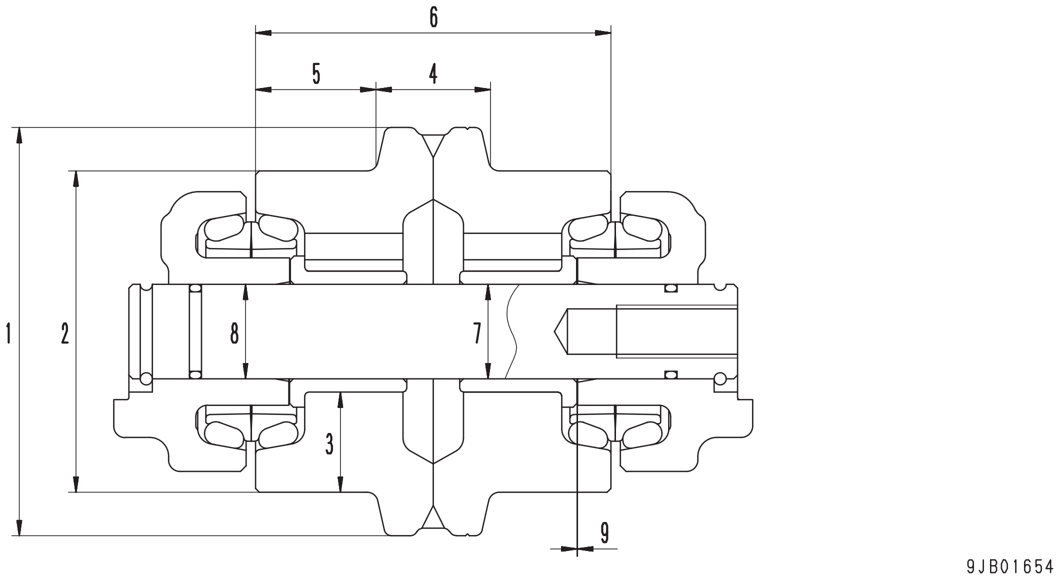
No.	Check item		Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	Remedy
7	Clearance between shaft and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	—	Replace
		PC40MR-2 PC50MR-2	ø 35	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	—	
8	Clearance between shaft and support	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.025 – 0.064	+ 0.060 0	0.025 – 0.124	—	
		PC40MR-2 PC50MR-2	ø 35	– 0.025 – 0.064	+ 0.060 0	0.025 – 0.124	—	

No.	Check item		Standard clearance	Clearance limit	Remedy
9	Play of shaft in axial direction	PC27MR-2 PC30MR-2 PC35MR-2	0.25	—	Replace
		PC40MR-2 PC50MR-2	0.25	—	

No.	Check item			Standard	Limit	Remedy
10	Height of idler guide	PC27MR-2 PC30MR-2 PC35MR-2	Track frame	95.5	100	Repair by overlaying welding
			Idler support	94	90	
		PC40MR-2 PC50MR-2	Track frame	120	124	
			Idler support	118	114	
11	Width of idler guide	PC27MR-2 PC30MR-2 PC35MR-2	Track frame	161.5	165	Repair by overlaying welding or replace
			Idler shaft	160	155	
		PC40MR-2 PC50MR-2	Track frame	161	165	
			Idler shaft	160	155	

TRACK ROLLER

★ This diagram shows PC27MR, 30MR, 35MR.

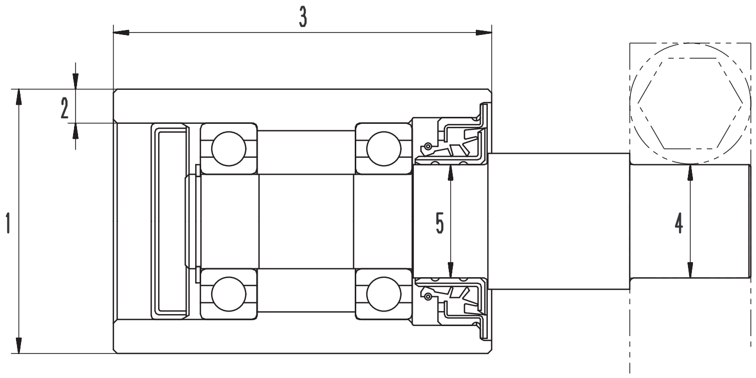


Unit: mm

No.	Check item		Criteria					Remedy
			Standard size			Repair limit		Repair by overlaying welding or replace
1	Outside diameter of flange	PC27MR-2 PC30MR-2 PC35MR-2	ø 108			—		
		PC40MR-2 PC50MR-2	ø 123			—		
2	Outside diameter of tread	PC27MR-2 PC30MR-2 PC35MR-2	ø 85			ø 77		
		PC40MR-2 PC50MR-2	ø 95			ø 87		
3	Thickness of tread	PC27MR-2 PC30MR-2 PC35MR-2	26.5			22.5		
		PC40MR-2 PC50MR-2	26.5			22.5		
4	Width of flange	PC27MR-2 PC30MR-2 PC35MR-2	30.3			24.3		
		PC40MR-2 PC50MR-2	41			35		
5	Width of tread	PC27MR-2 PC30MR-2 PC35MR-2	31.85			—		
		PC40MR-2 PC50MR-2	34.6			—		
6	Total width	PC27MR-2 PC30MR-2 PC35MR-2	94			—		
		PC40MR-2 PC50MR-2	110			—		
			Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
7	Clearance between shaft and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 25	0 – 0.013	+ 0.183 + 0.144	0.144 – 0.195	—	
		PC40MR-2 PC50MR-2	ø 35	– 0.025 – 0.050	+ 0.142 + 0.080	0.105 – 0.192	—	
8	Clearance between shaft and collar	PC27MR-2 PC30MR-2 PC35MR-2	ø 25	0 – 0.013	+ 0.033 0	0 – 0.046	—	
		PC40MR-2 PC50MR-2	ø 35	– 0.025 – 0.050	+ 0.039 0	0.025 – 0.089	—	
			Standard clearance			Clearance limit		
9	Play of roller in axial direction	PC27MR-2 PC30MR-2 PC35MR-2	0.15 – 0.32			—		
		PC40MR-2 PC50MR-2	0.17 – 0.40			—		

CARRIER ROLLER

★ This diagram shows PC27MR, 30MR, 35MR.



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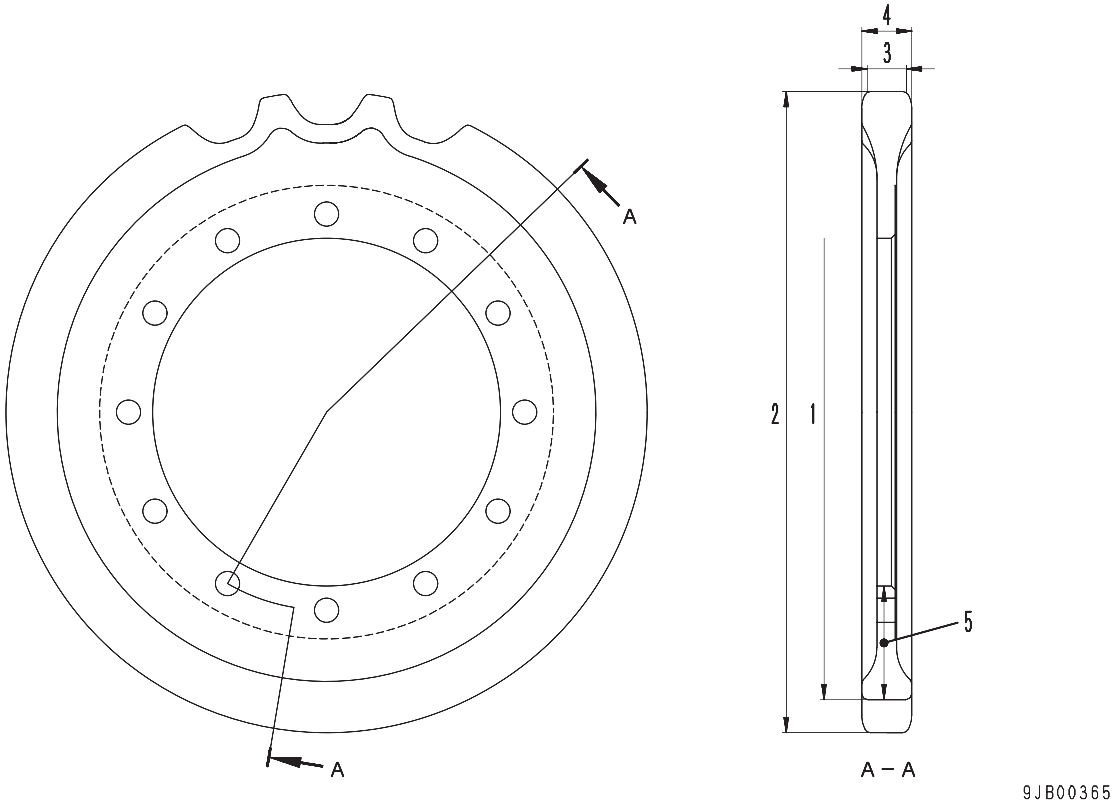
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of tread</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td><td rowspan="4">Repair by overlaying welding or replace</td></tr>
<tr><td colspan="2">ø 70</td><td colspan="3">ø 65</td></tr>
<tr><td>2</td><td>Thickness of tread</td><td colspan="2">9</td><td colspan="3">6.5</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">100</td><td colspan="3">—</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Clearance between shaft and support</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="6">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 30</td><td>– 0.050
– 0.100</td><td>+ 0.210
0</td><td>0.050 –
0.310</td><td>—</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Interference between shaft and seal</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 30</td><td>0
– 0.052</td><td>– 0.200
– 0.400</td><td>0.148 –
0.400</td><td>—</td></tr>
</table>

SPROCKET

★ This diagram shows PC40MR, 50MR.



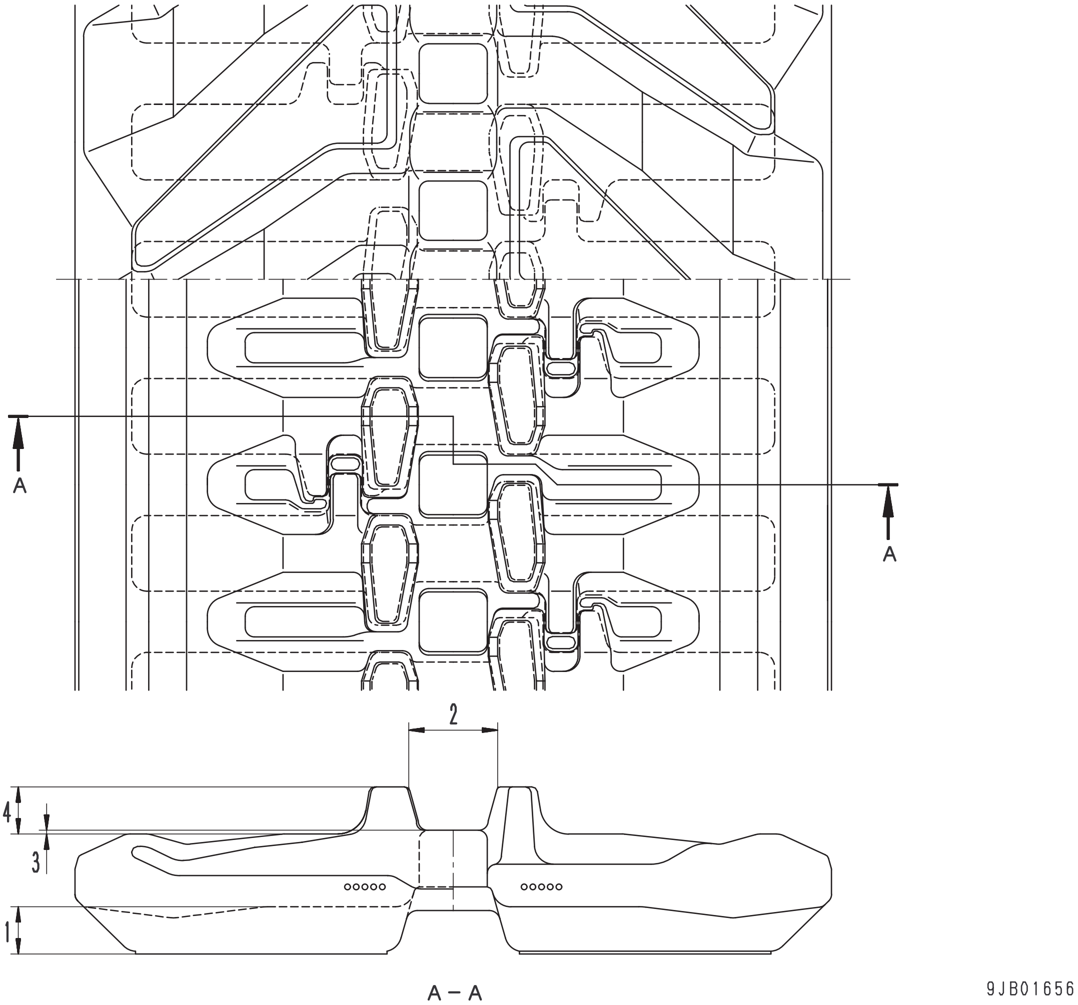
Unit: mm

No.	Check item		Criteria			Remedy
			Standard size	Tolerance	Repair limit	
1	Wear of root circle diameter	PC27MR-2 PC30MR-2 PC35MR-2	ø 344.3	+ 1.0 – 2.0	ø 332	Repair by overlaying welding or replace
		PC40MR-2 PC50MR-2	ø 380.37	+ 1.0 – 2.0	ø 368	
2	Wear of tip circle diameter	PC27MR-2 PC30MR-2 PC35MR-2	ø 386.2	± 1.5	ø 374	
		PC40MR-2 PC50MR-2	ø 423.99	0 – 3.0	ø 412	
3	Wear of tip width	PC27MR-2 PC30MR-2 PC35MR-2	20	—	18	
		PC40MR-2 PC50MR-2	26	—	24	
4	Wear of bottom width	PC27MR-2 PC30MR-2 PC35MR-2	27	+ 0.5 – 1.0	24	
		PC40MR-2 PC50MR-2	33	+ 0.5 – 1.0	30	
5	Thickness of bottom	PC27MR-2 PC30MR-2 PC35MR-2	77.15	+ 0.475 – 1.061	71	
		PC40MR-2 PC50MR-2	75.185	+ 0.492 – 1.075	69	

TRACK SHOE

RUBBER SHOE

★ This diagram shows PC40MR, 50MR.



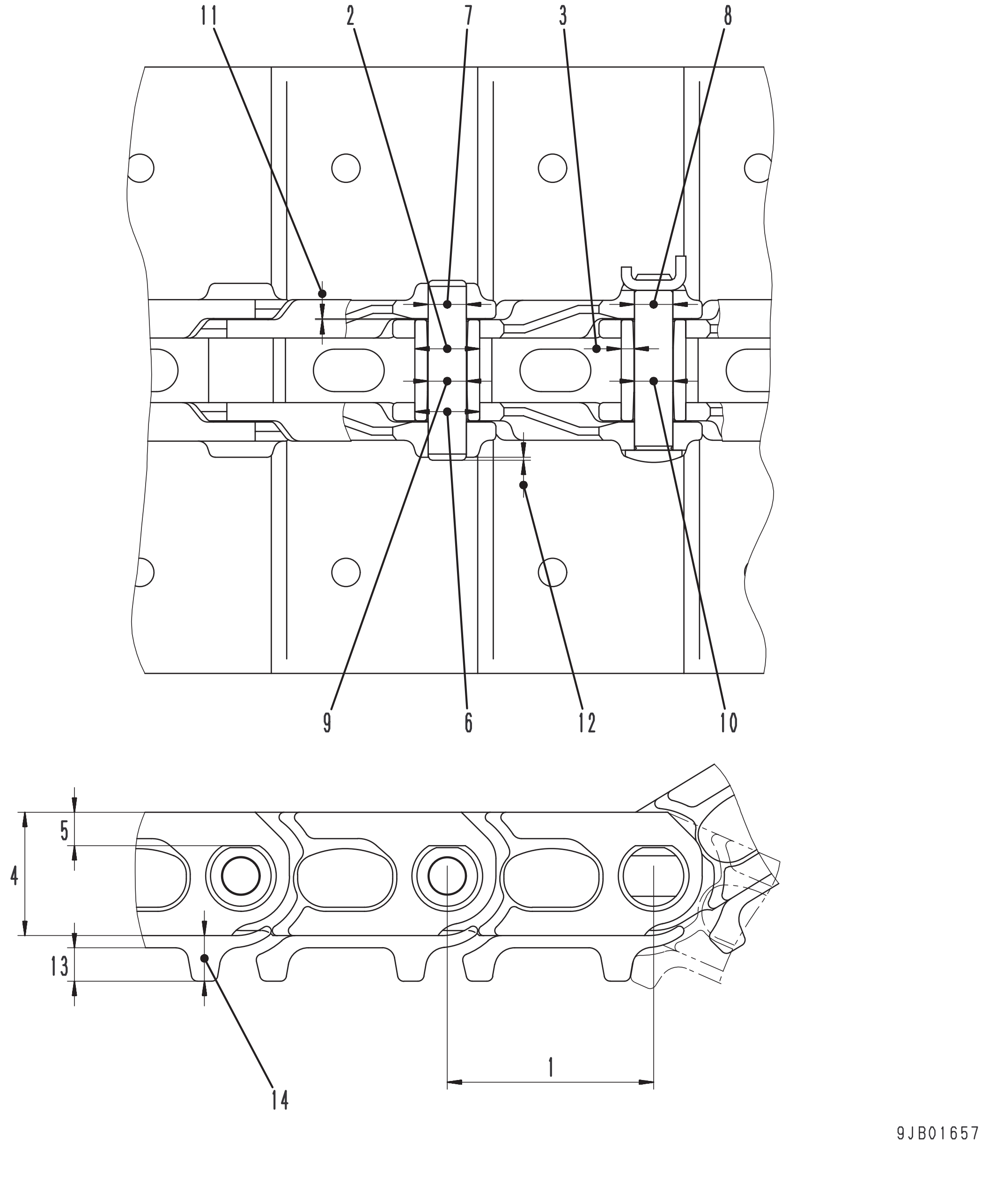
Unit: mm

No.	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Wear of lug height	PC27MR-2 PC30MR-2 PC35MR-2	23	5	Replace
		PC40MR-2 PC50MR-2	25	5	
2	Wear of roller guide	PC27MR-2 PC30MR-2 PC35MR-2	34	42	
		PC40MR-2 PC50MR-2	47	60	
3	Wear of meshing parts of sprocket	PC27MR-2 PC30MR-2 PC35MR-2	– 1.5	– 6.5	
		PC40MR-2 PC50MR-2	2	– 3	
4	Wear of roller tread height	PC27MR-2 PC30MR-2 PC35MR-2	22.5	16.5	
		PC40MR-2 PC50MR-2	25	19	

DOUBLE GROUSER SHOE

PC27MR, 30MR, 35MR-2

(If equipped)



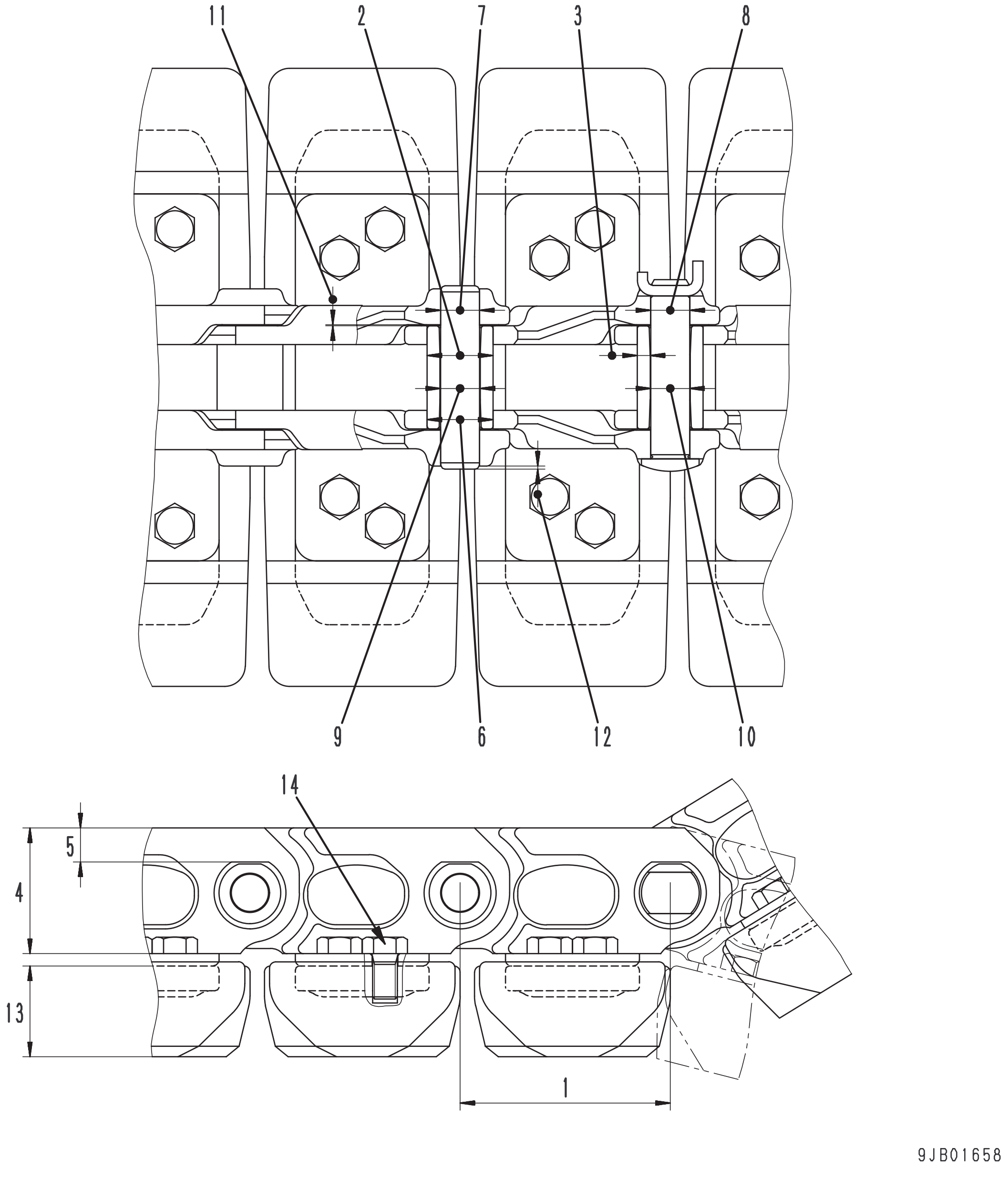
9JB01657

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="8">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Link pitch</td><td colspan="2">Standard size</td><td colspan="4">Turning limit</td><td colspan="2">Repair limit</td><td rowspan="3">If link pitch exceeds repair limit, replace bushing and pin.</td></tr>
<tr><td colspan="2">102</td><td colspan="4">—</td><td colspan="2">107</td></tr>
<tr><td>2</td><td>Outside diameter of bushing</td><td colspan="2">32</td><td colspan="4">—</td><td colspan="2">26</td></tr>
<tr><td>3</td><td>Thickness of bushing</td><td colspan="2">6.25</td><td colspan="4">—</td><td colspan="2">3.25</td><td>Turn or replace</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Height of link</td><td colspan="4">Standard size</td><td colspan="4">Repair limit</td><td rowspan="3">Repair by over-laying welding or replace</td></tr>
<tr><td colspan="4">61</td><td colspan="4">55</td></tr>
<tr><td>5</td><td>Thickness of link
(Bushing fitting part)</td><td colspan="4">15.5</td><td colspan="4">9.5</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Interference between bushing and link</td><td rowspan="2">Standard size</td><td colspan="4">Tolerance</td><td colspan="2" rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td><td rowspan="9">Replace</td></tr>
<tr><td colspan="2">Shaft</td><td colspan="2">Hole</td></tr>
<tr><td>ø 32</td><td colspan="2">+ 0.15
+ 0.12</td><td colspan="2">+ 0.05
0</td><td colspan="2">0.07 – 0.15</td><td>—</td></tr>
<tr><td>7</td><td>Interference between regular pin and link</td><td>ø 19</td><td colspan="2">+ 0.27
+ 0.12</td><td colspan="2">+ 0.05
0</td><td colspan="2">0.07 – 0.27</td><td>—</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Clearance between master pin and link</td><td rowspan="2">Standard size</td><td colspan="4">Tolerance</td><td colspan="2" rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td colspan="2">Shaft</td><td colspan="2">Hole</td></tr>
<tr><td>Shaft ø18.93
Hole ø19</td><td colspan="2">+ 0.05
0</td><td colspan="2">+ 0.05
0</td><td colspan="2">0.02 – 0.12</td><td>—</td></tr>
<tr><td>9</td><td>Clearance between regular pin and bushing</td><td>Shaft ø19
Hole ø19.5</td><td colspan="2">+ 0.27
+ 0.12</td><td colspan="2">± 0.20</td><td colspan="2">0.03 – 0.58</td><td>—</td></tr>
<tr><td>10</td><td>Clearance between master pin and bushing</td><td>Shaft ø18.93
Hole ø19.5</td><td colspan="2">+ 0.05
0</td><td colspan="2">± 0.20</td><td colspan="2">0.32 – 0.77</td><td>—</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Clearance of link mating face</td><td colspan="2">Standard clearance
(Each side)</td><td colspan="4">Standard clearance
(Both sides)</td><td colspan="2">Standard clearance
(Each side)</td><td rowspan="3">Adjust</td></tr>
<tr><td colspan="2">0.2 – 0.9</td><td colspan="4">0.4 – 1.8</td><td colspan="2">—</td></tr>
<tr><td>12</td><td>Projection of regular pin</td><td colspan="8">1.5</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Height of grouser</td><td colspan="4">Standard size</td><td colspan="4">Repair limit</td><td rowspan="3">Weld lug or re-place</td></tr>
<tr><td colspan="4">16.5</td><td colspan="4">10</td></tr>
<tr><td>14</td><td>Thickness of grouser</td><td colspan="4">22</td><td colspan="4">15.5</td></tr>
</table>

ROAD LINER
PC27MR, 30MR, 35MR-2

(If equipped)



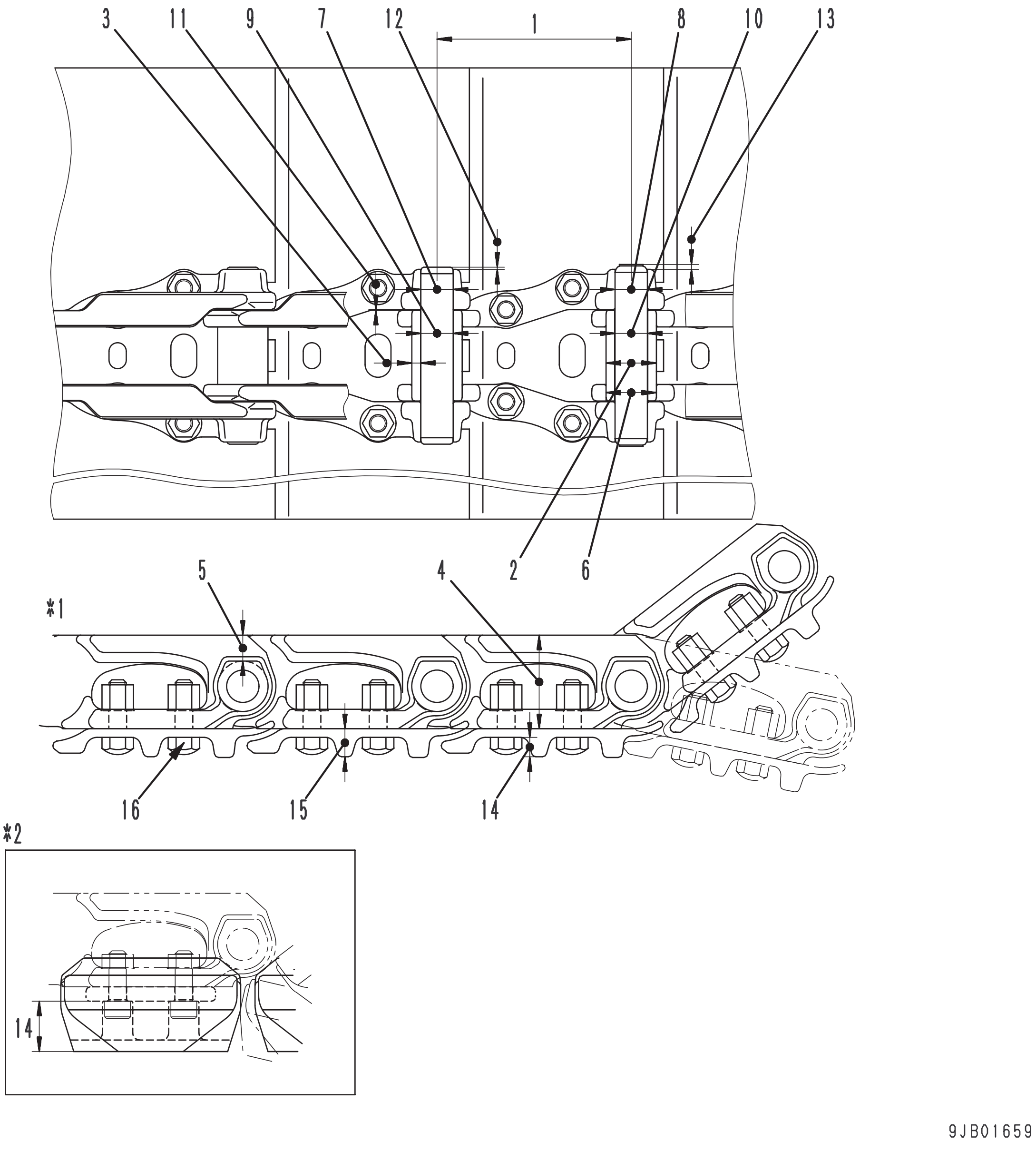
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Link pitch</td><td colspan="2">Standard size</td><td colspan="2">Turning limit</td><td colspan="2">Repair limit</td><td rowspan="3">If link pitch exceeds repair limit, replace bushing and pin.</td></tr>
<tr><td colspan="2">102</td><td colspan="2">—</td><td colspan="2">107</td></tr>
<tr><td>2</td><td>Outside diameter of bushing</td><td colspan="2">32</td><td colspan="2">—</td><td colspan="2">26</td></tr>
<tr><td>3</td><td>Thickness of bushing</td><td colspan="2">6.25</td><td colspan="2">—</td><td colspan="2">3.25</td><td>Turn or replace</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Height of link</td><td colspan="3">Standard size</td><td colspan="3">Repair limit</td><td rowspan="3">Repair by over-laying welding or replace</td></tr>
<tr><td colspan="3">61</td><td colspan="3">55</td></tr>
<tr><td>5</td><td>Thickness of link
(Bushing fitting part)</td><td colspan="3">15.5</td><td colspan="3">9.5</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Interference between bushing and link</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2" colspan="2">Interference limit</td><td rowspan="9">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 32</td><td>+ 0.15
+ 0.12</td><td>+ 0.05
0</td><td>0.07 – 0.15</td><td colspan="2">—</td></tr>
<tr><td>7</td><td>Interference between regular pin and link</td><td>ø 19</td><td>+ 0.27
+ 0.12</td><td>+ 0.05
0</td><td>0.07 – 0.27</td><td colspan="2">—</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Clearance between master pin and link</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2" colspan="2">Clearance limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Shaft ø18.93
Hole ø19</td><td>+ 0.05
0</td><td>+ 0.05
0</td><td>0.02 – 0.12</td><td colspan="2">—</td></tr>
<tr><td>9</td><td>Clearance between regular pin and bushing</td><td>Shaft ø19
Hole ø19.5</td><td>+ 0.27
+ 0.12</td><td>± 0.20</td><td>0.03 – 0.58</td><td colspan="2">—</td></tr>
<tr><td>10</td><td>Clearance between master pin and bushing</td><td>Shaft ø18.93
Hole ø19.5</td><td>+ 0.05
0</td><td>± 0.20</td><td>0.32 – 0.77</td><td colspan="2">—</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Clearance of link mating face</td><td colspan="2">Standard clearance
(Each side)</td><td colspan="2">Standard clearance
(Both sides)</td><td colspan="2">Standard clearance
(Each side)</td><td rowspan="3">Adjust</td></tr>
<tr><td colspan="2">0.2 – 0.9</td><td colspan="2">0.4 – 1.8</td><td colspan="2">—</td></tr>
<tr><td>12</td><td>Projection of regular pin</td><td colspan="6">1.5</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Height of grouser</td><td colspan="3">Standard size</td><td colspan="3">Repair limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="3">44</td><td colspan="3">20</td></tr>
<tr><td>14</td><td>Tightening torque of shoe bolt</td><td colspan="6">130 – 145 Nm {13 – 14.5 kgm}</td><td>Retighten</td></tr>
</table>

TRIPLE GROUSER SHOE AND ROAD LINER

PC40MR, 50MR-2

(If equipped)



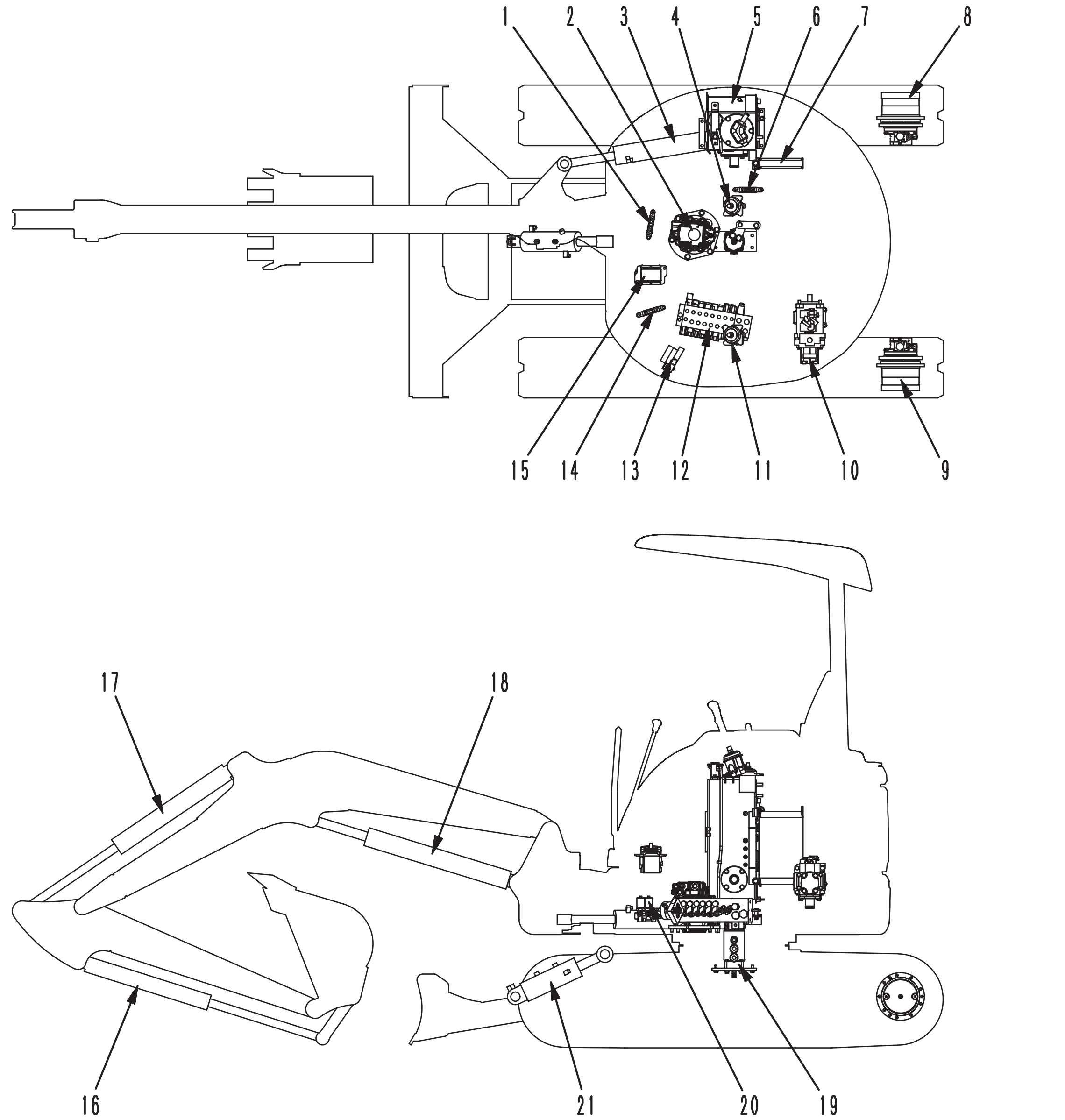
*1: Triple grouser shoe
*2: Road liner

Unit: mm

No.	Check item		Criteria					Remedy
			Standard size	Turning limit	Repair limit			
1	Link pitch		135	138	143			The pin and bushing are able to use in reverse until reach to reverse limit. If these had exceeded the repair limit, replace pin • bushing or link assembly.
2	Outside diameter of bushing		35	32	29			
3	Thickness of bushing		6.05	4.55	3.05			
			Standard size	Repair limit				
4	Height of link		65	59				Repair by over-laying welding or replace
5	Thickness of link (Bushing fitting part)		18.075	12.075				
			Standard size	Tolerance: Shaft	Tolerance: Hole	Standard interference	Interference limit	
6	Interference between bushing and link		Shaft ⌀35 Hole ⌀34.85	+ 0.030 0	+ 0.040 0	0.110 – 0.180	—	Replace
7	Interference between regular pin and link		Shaft ⌀22.5 Hole ⌀22.3	+ 0.060 0	+ 0.052 0	0.148 – 0.260	—	
8	Interference between master pin and link		Shaft ⌀22.5 Hole ⌀22.3	– 0.030 – 0.070	+ 0.052 0	0.078 – 0.170	—	
			Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	
9	Clearance between regular pin and bushing		Shaft ⌀22.5 Hole ⌀22.9	+ 0.060 0	± 0.2	0.140 – 0.600	—	
10	Clearance between master pin and bushing		Shaft ⌀22.5 Hole ⌀22.9	– 0.200 – 0.400	± 0.2	0.400 – 1.000	—	
			Standard clearance (Each side)	Standard clearance (Both sides)	Standard clearance (Each side)			
11	Clearance of link mating face		0.7 – 1.4	1.4 – 2.8	—			Adjust
12	Projection of regular pin		1.5					
13	Projection of master pin		3.25					
			Standard size	Repair limit				
14	Height of grouser	• Triple	14	10				Repair by over-laying welding or replace
		• Road liner	35	17				Replace
15	Thickness of grouser	• Triple	20	16				Repair by over-laying welding or replace
16	Tightening torque of shoe bolt		137 ± 19.6 Nm {14 ± 2 kgm}					Retighten

HYDRAULIC COMPONENTS LAYOUT DRAWING

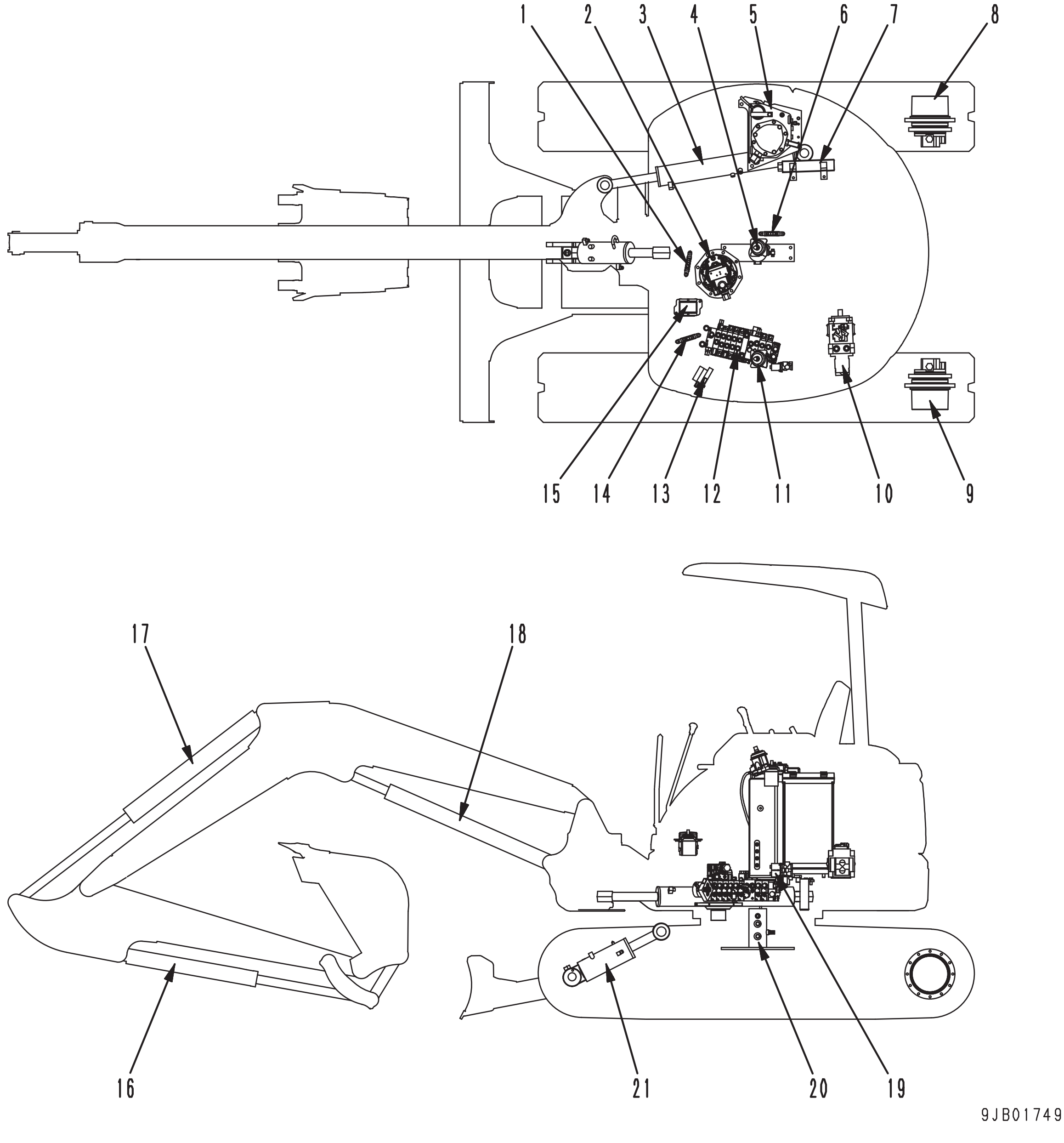
PC27MR, 30MR, 35MR-2



9JB01748

1. Boom swing PPC valve
2. Swing motor
3. Boom swing cylinder
4. Right work equipment PPC valve
5. Hydraulic tank
6. Blade PPC valve
7. Oil cooler
8. Right travel motor
9. Left travel motor
10. Hydraulic pump
11. Left work equipment PPC valve
12. Control valve
13. Multi-control valve
14. Attachment PPC valve (If equipped)
15. Travel PPC valve
16. Bucket cylinder
17. Arm cylinder
18. Boom cylinder
19. Center swivel joint
20. 2-spool solenoid valve
21. Blade cylinder

PC40MR, 50MR-2



1. Boom swing PPC valve
2. Swing motor
3. Boom swing cylinder
4. Right work equipment PPC valve
5. Hydraulic tank
6. Blade PPC valve
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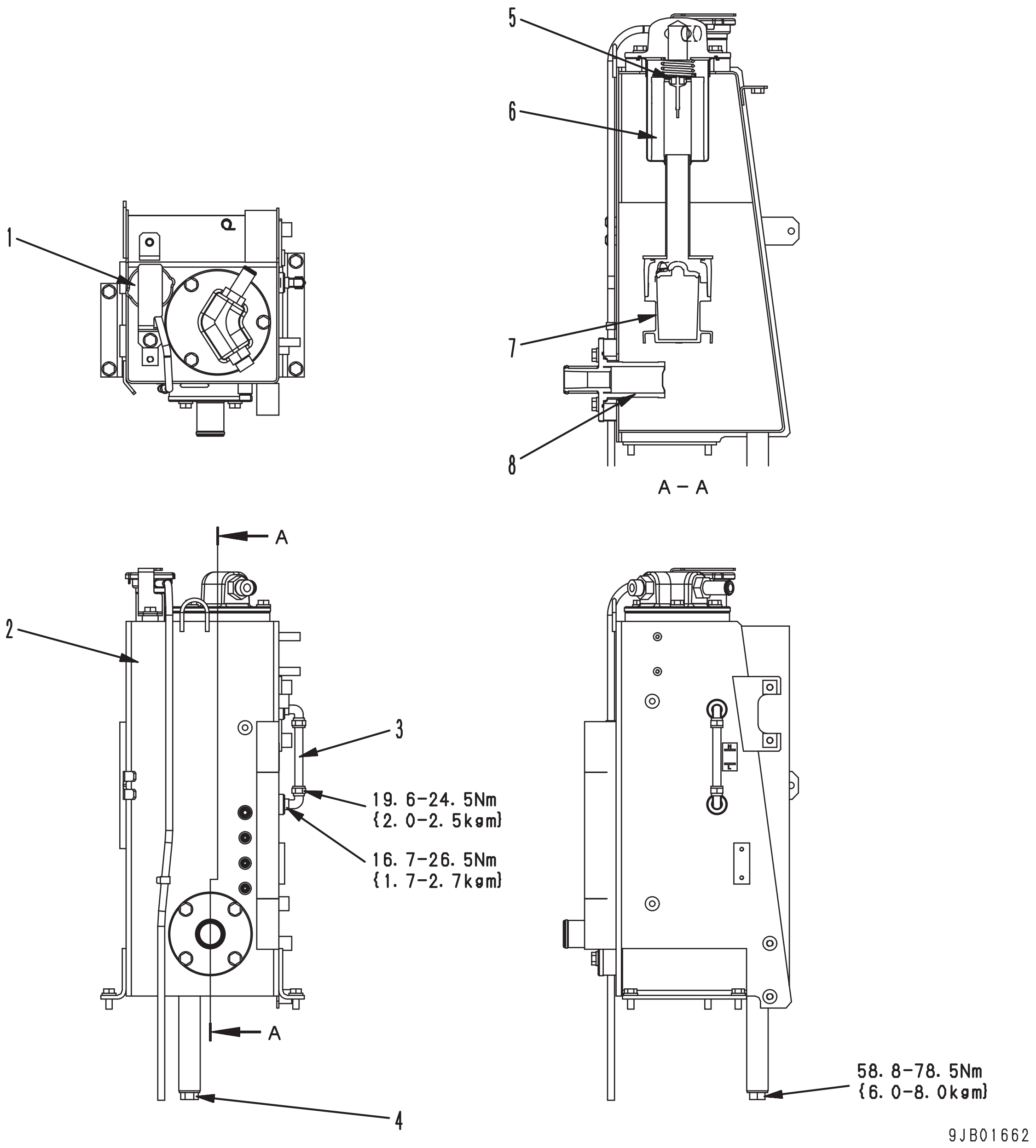
15. Travel PPC valve
16. Bucket cylinder
17. Arm cylinder
18. Boom cylinder
19. 2-spool solenoid valve
20. Center swivel joint
21. Blade cylinder

HYDRAULIC TANK

PC27MR, 30MR, 35MR-2

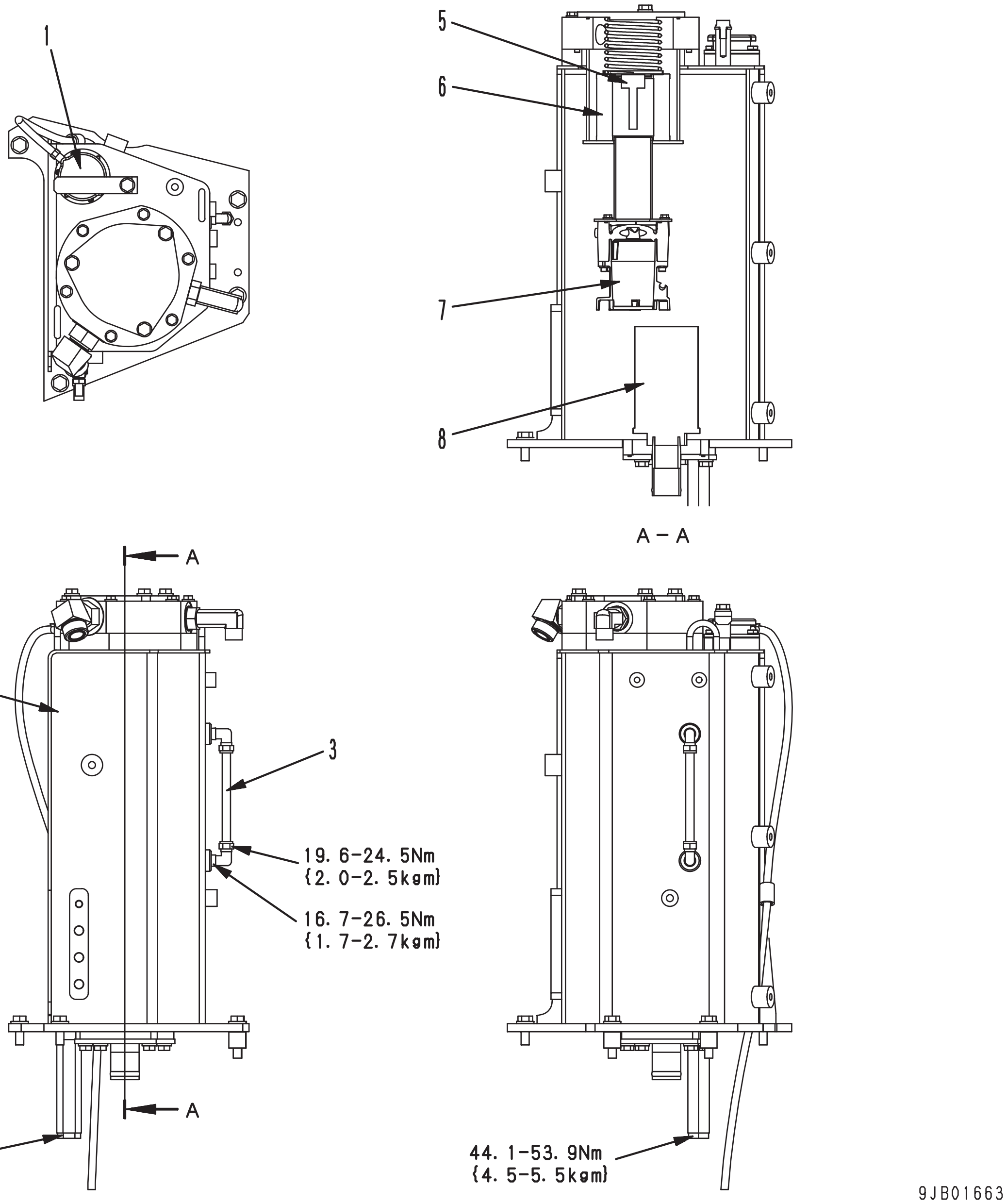


1. Filler cap
2. Hydraulic tank
3. Sight gauge
4. Drain plug
5. Bypass valve
6. Filter element
7. Cyclone assembly
8. Strainer

SPECIFICATIONS

Tank capacity (ℓ)	30
Oil amount (ℓ)	20
Bypass valve set pressure (kPa {kg/cm²})	150 ± 30 {1.53 ± 0.31}
Pressure valve cracking pressure (kPa {kg/cm²})	70 ± 15 {0.71 ± 0.15}
Vacuum valve cracking pressure (kPa {kg/cm²})	0 – 5 {0 – 0.05}

PC40MR, 50MR-2

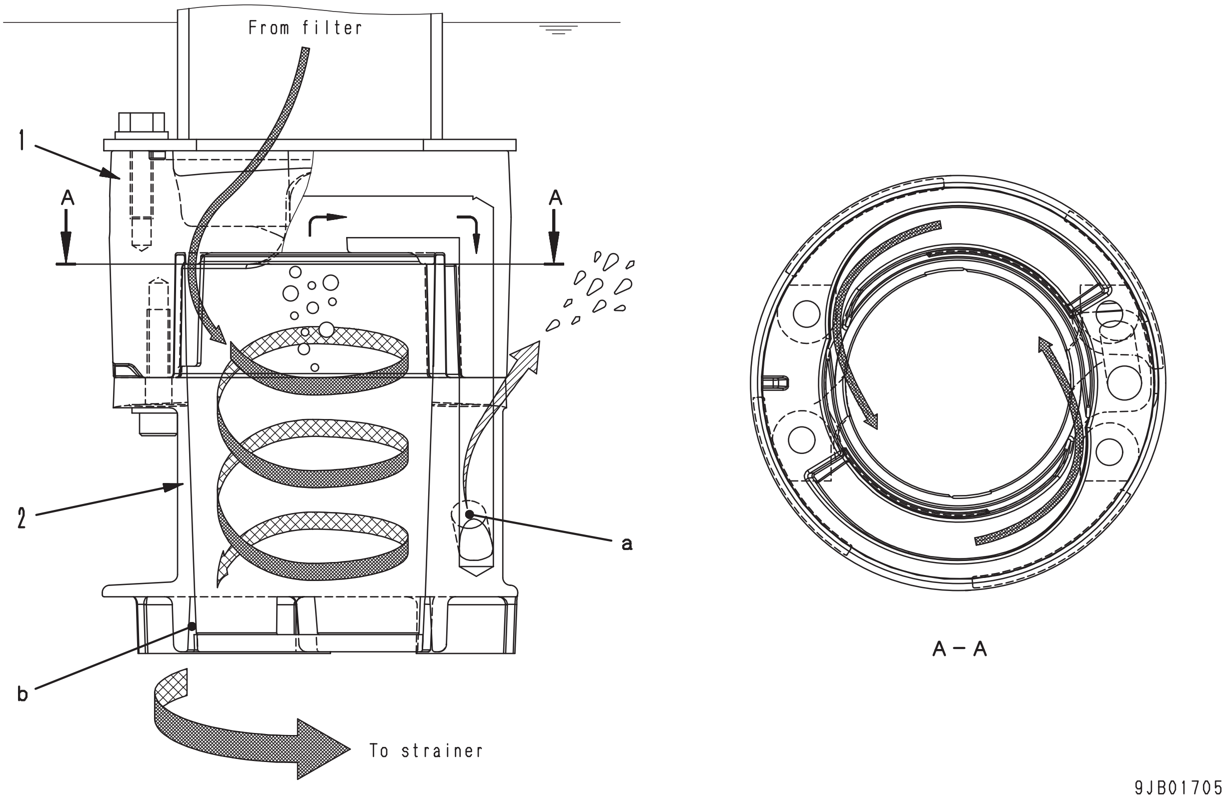


1. Filler cap
2. Hydraulic tank
3. Sight gauge
4. Drain plug
5. Bypass valve
6. Filter element
7. Cyclone assembly
8. Strainer

SPECIFICATIONS

Tank capacity (ℓ)	33
Oil amount (ℓ)	20
Bypass valve set pressure (kPa {kg/cm^2})	150 ± 30 {1.53 ± 0.31}
Pressure valve cracking pressure (kPa {kg/cm^2})	38 ± 15 {0.39 ± 0.15}
Vacuum valve cracking pressure (kPa {kg/cm^2})	0 – 5 {0 – 0.05}

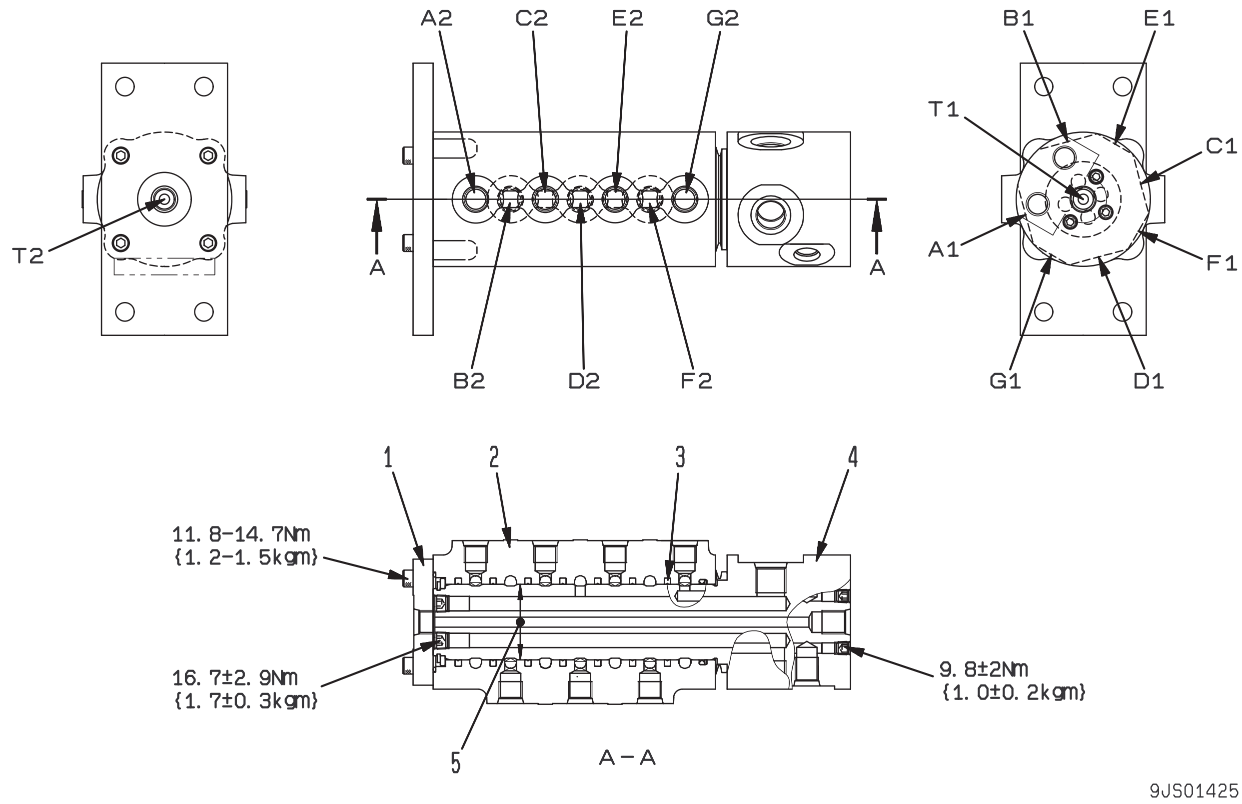
OPERATION OF CYCLONE ASSEMBLY



- The hydraulic oil returning from each actuator flows through the filter to block (1) of the cyclone assembly.
- When the hydraulic oil flows from block (1) into the cylindrical part of cyclone (2), it swirls and its speed is increased.
- Since the hydraulic oil swirls, a centrifugal force is generated and bubbles of low specific gravity gather to the center.
- The bubbles gathering to the center are discharged through the upper center of block (1) and outlet (**a**) on the side of cyclone (2) into the hydraulic oil in the tank. The hydraulic oil and air are separated in this way.
- The hydraulic oil containing no bubbles is discharged through outlet (**b**) at the bottom of cyclone (2), and then it flows through the strainer into the pump again.

CENTER SWIVEL JOINT

PC27MR-2



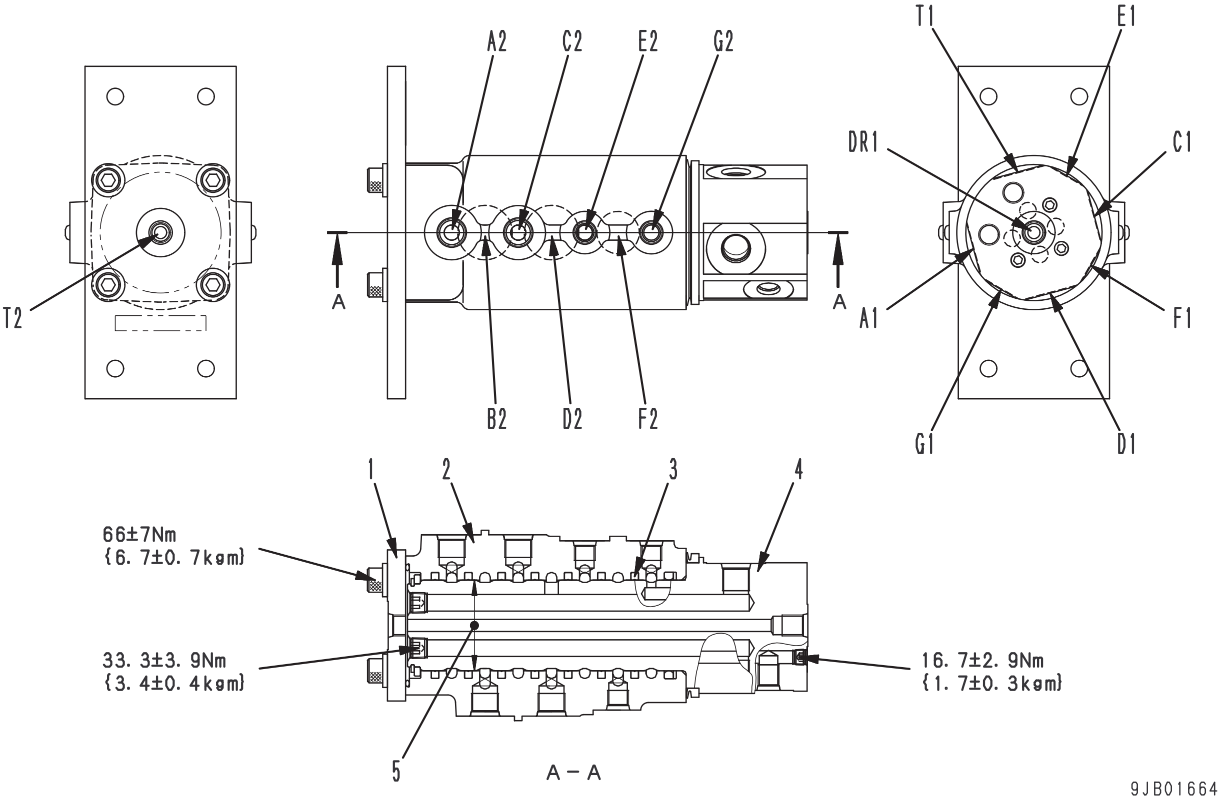
A1 : From R.H. travel control valve
A2 : To R.H. travel motor
B1 : From L.H. travel control valve
B2 : To L.H. travel motor
C1 : From R.H. travel control valve
C2 : To R.H. travel motor
D1 : From L.H. travel control valve
D2 : To L.H. travel motor
E1 : From blade control valve
E2 : To blade cylinder head
F1 : From blade control valve
F2 : To blade cylinder bottom
G1 : From travel Hi-Lo speed selector solenoid valve
G2 : To travel Hi-Lo speed selector valve
T1 : To hydraulic tank
T2 : From travel motor drain port

1. Shaft
2. Rotor
3. Slipper seal
4. Cover

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Standard clearance	Clearance limit	
5	Clearance between rotor and shaft	⌀ 60	0.055 – 0.085	0.090	Replace

PC30MR, 35MR-2



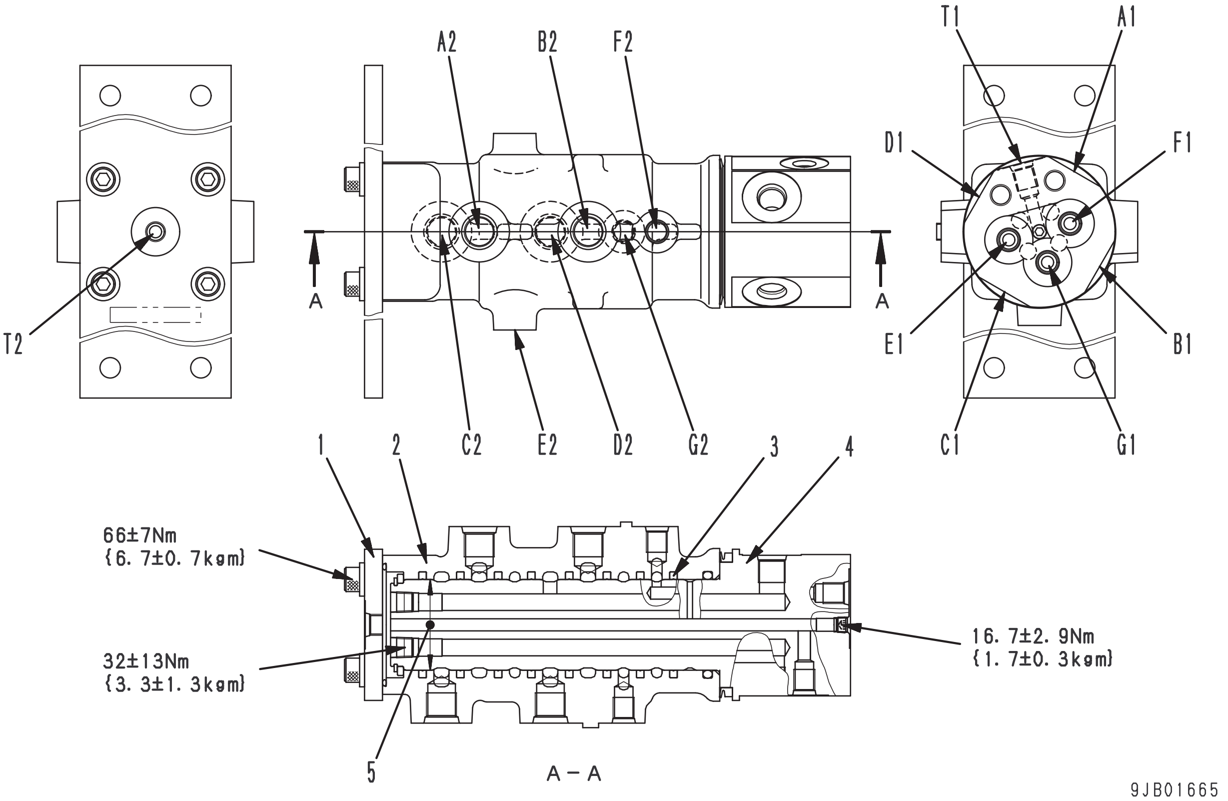
A1 : From R.H. travel control valve
A2 : To R.H. travel motor
B1 : From L.H. travel control valve
B2 : To L.H. travel motor
C1 : From R.H. travel control valve
C2 : To R.H. travel motor
D1 : From L.H. travel control valve
D2 : To L.H. travel motor
E1 : From blade control valve
E2 : To blade cylinder head
F1 : From blade control valve
F2 : To blade cylinder bottom
G1 : From travel Hi-Lo speed selector solenoid valve
G2 : To travel Hi-Lo speed selector valve
T1 : To hydraulic tank
T2 : From travel motor drain port

1. Shaft
2. Rotor
3. Slipper seal
4. Cover

Unit: mm

No.	Check item	Criteria			Remedy
5	Clearance between rotor and shaft	Standard size	Standard clearance	Clearance limit	Replace
		ø 60	0.055 – 0.085	0.090	

PC40MR, 50MR-2



A1 : From L.H. travel control valve
A2 : To L.H. travel motor
B1 : From L.H. travel control valve
B2 : To L.H. travel motor
C1 : From R.H. travel control valve
C2 : To R.H. travel motor
D1 : From R.H. travel control valve
D2 : To R.H. travel motor
E1 : From travel Hi-Lo speed selector valve
E2 : To travel Hi-Lo speed selector valve
F1 : From blade control valve
F2 : To blade cylinder head
G1 : From blade control valve
G2 : To blade cylinder bottom
T1 : To hydraulic tank
T2 : From travel motor drain port

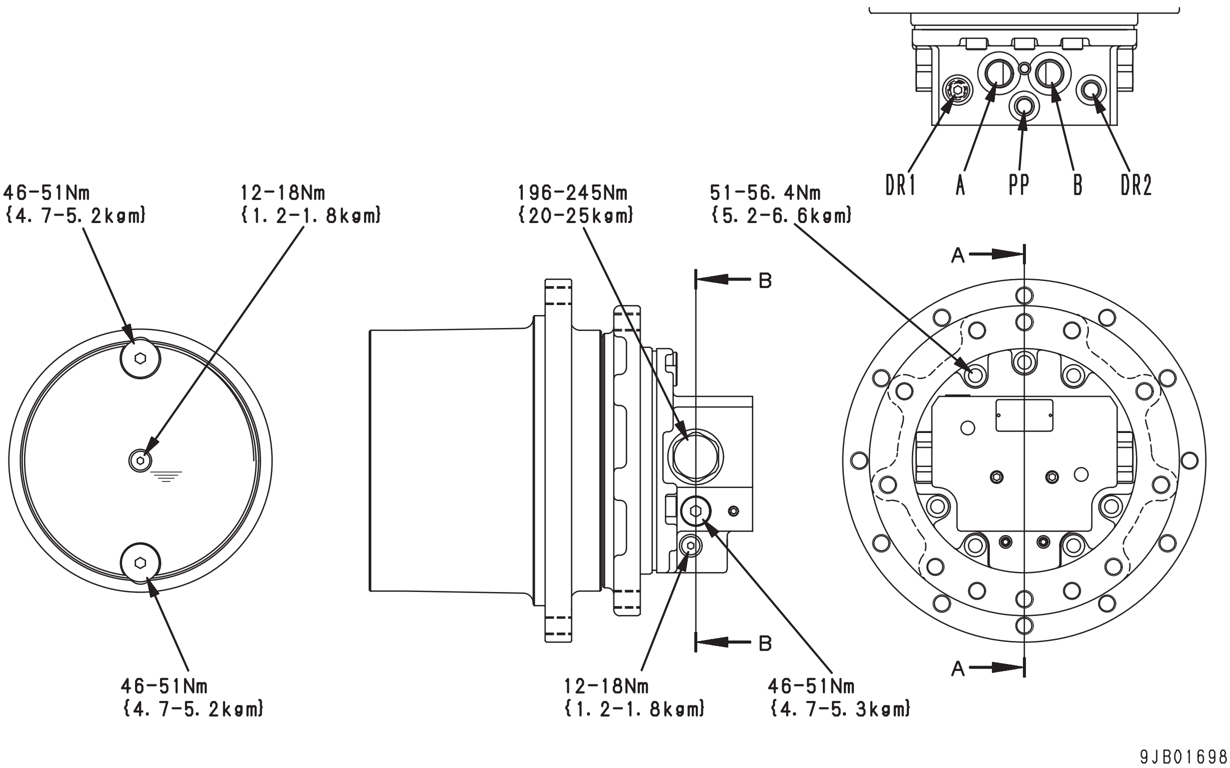
1. Shaft
2. Rotor
3. Slipper seal
4. Cover

Unit: mm

No.	Check item	Criteria			Remedy
5	Clearance between rotor and shaft	Standard size	Standard clearance	Clearance limit	Replace
		⌀ 60	0.055 – 0.085	0.090	

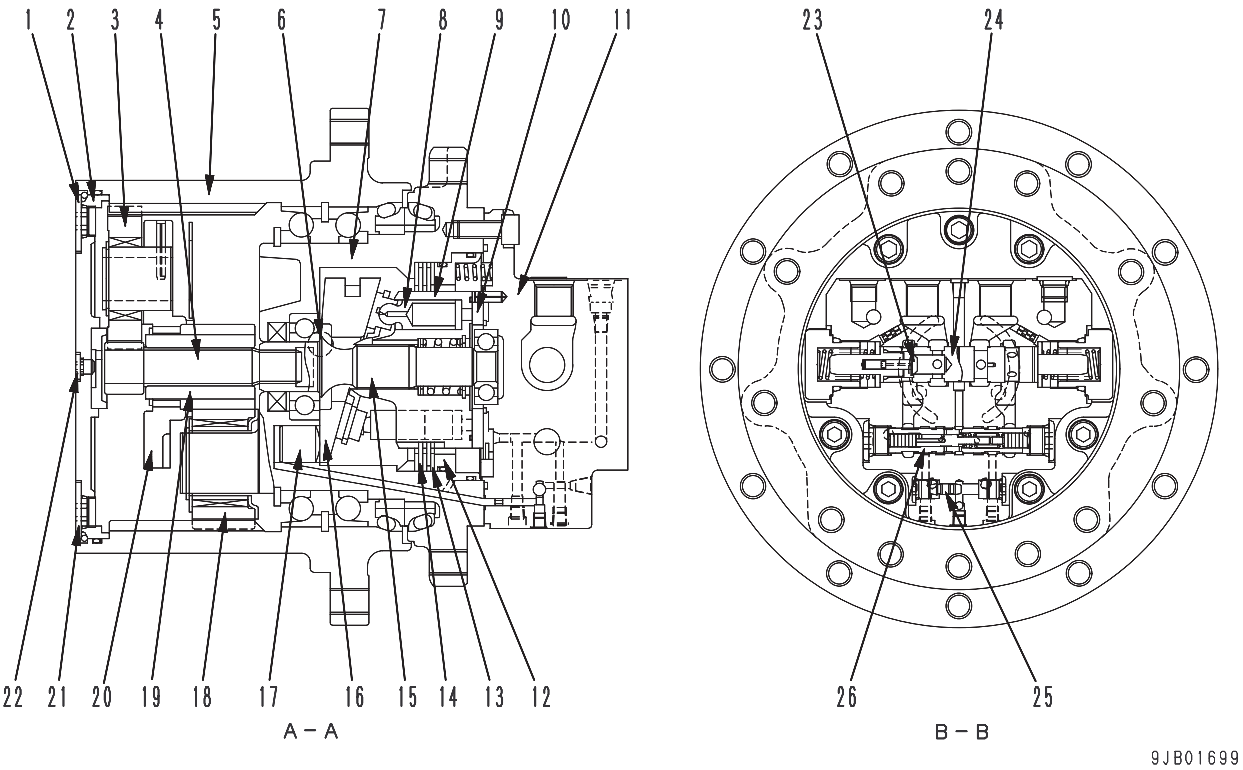
TRAVEL MOTOR

★ This diagram shows PC40MR, 50MR.



A : From travel control valve
B : From travel control valve
PP : From travel speed Hi-Lo selector solenoid valve
DR1 : To tank (left side)
Plug (right side)
DR2 : Plug (left side)
To tank (right side)

★ This diagram shows PC40MR, 50MR.



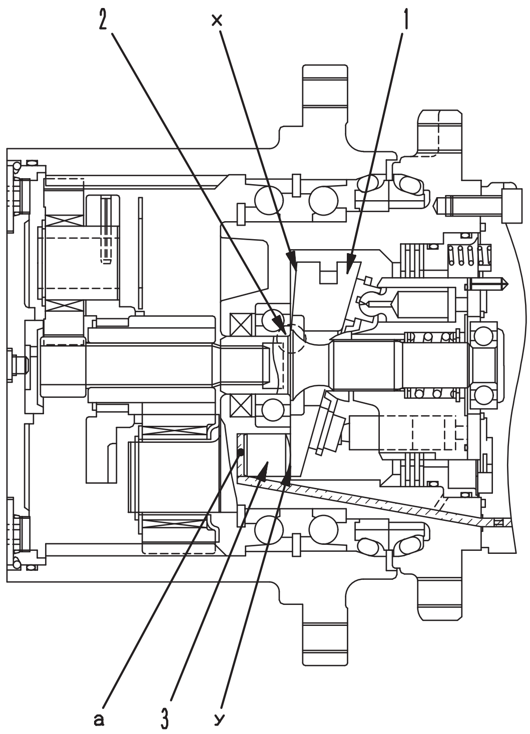
1. Oil filler plug
2. Cover
3. No. 2 planetary gear
4. No. 2 sun gear
5. Ring gear
6. Ball
7. Housing
8. Piston
9. Cylinder
10. Valve plate
11. Brake valve
12. Brake piston
13. Plate
14. Disc
15. Shaft
16. Swash plate
17. Control piston
18. No. 1 planetary gear
19. No. 1 sun gear
20. No. 2 planetary carrier
21. Drain plug
22. Oil level plug
23. Check valve
24. Counterbalance valve
25. Check valve
26. Automatic speed changing valve

SPECIFICATIONS

Model		PC27MR-2 PC30MR-2 PC35MR-2	PC40MR-2 PC50MR-2
Type		PHV-3B	PHV-4B
Theoretical delivery (cm^3/rev)	Hi	12.2	19.11
	Lo	22.1	33.08
Rated speed (rpm)	Hi	2,988	2,670
	Lo	1,650	1,540
Brake cracking pressure (MPa {kg/cm^2})		2.0 {20}	0.76 {7.8}
Speed changing pressure (MPa {kg/cm^2})		3.4 {35}	0.86 ± 0.1 {8.8 ± 1}
Automatic speed changing pressure (MPa {kg/cm^2})	Hi → Lo	21.3 {217}	23.5 {240}
	Lo → Hi	19.8 {202}	12.7 {130}
Reduction ratio		45.2	47.53

OUTLINE

- Swash plate (1) has two rear faces **x** and **y**, and ball is supported by the ball (2).
- The travel speed is switched by pressurized oil from control chamber **a** acting on control piston (3). This switches the angle of swash plate (1) between the maximum angle and minimum angle to determine the travel speed.



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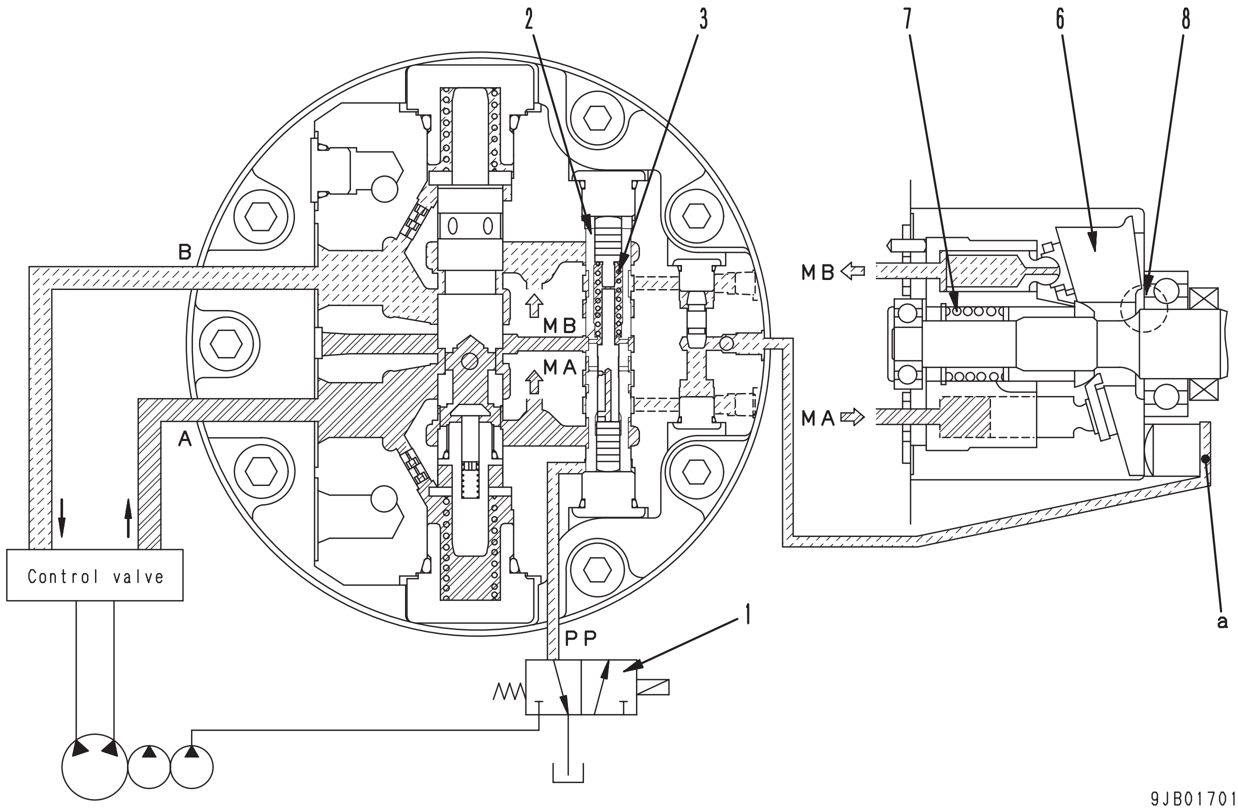
OPERATION OF MOTOR

At low speed (When motor swash plate angle is at maximum)

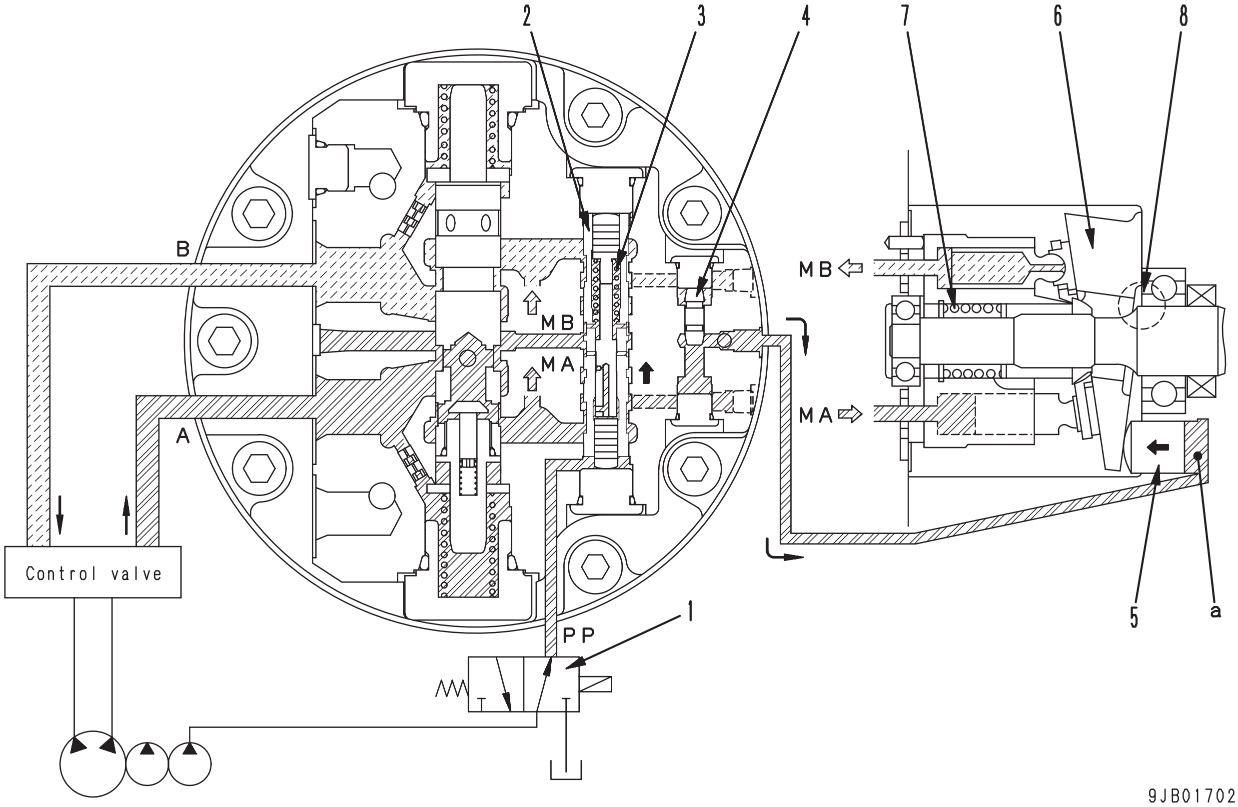
★ This diagram shows PC40MR, 50MR.



- Since 2nd travel speed selection solenoid valve (1) is turned OFF, the hydraulic oil from the control pump does not flow to port **PP**.
- Since automatic speed changing valve (2) is pressed down by spring (3), the circuit to control chamber **a** is shut off.
- Since control chamber **a** is connected to the drain port, swash plate (6) is pressed to the right by the reaction force of center spring (7).
- Accordingly, swash plate (6) leans around ball (8) toward the maximum swash plate angle side and the motor capacity becomes maximum and the travel speed decreases.

At high speed (When motor swash plate angle is at minimum)

★ This diagram shows PC40MR, 50MR.



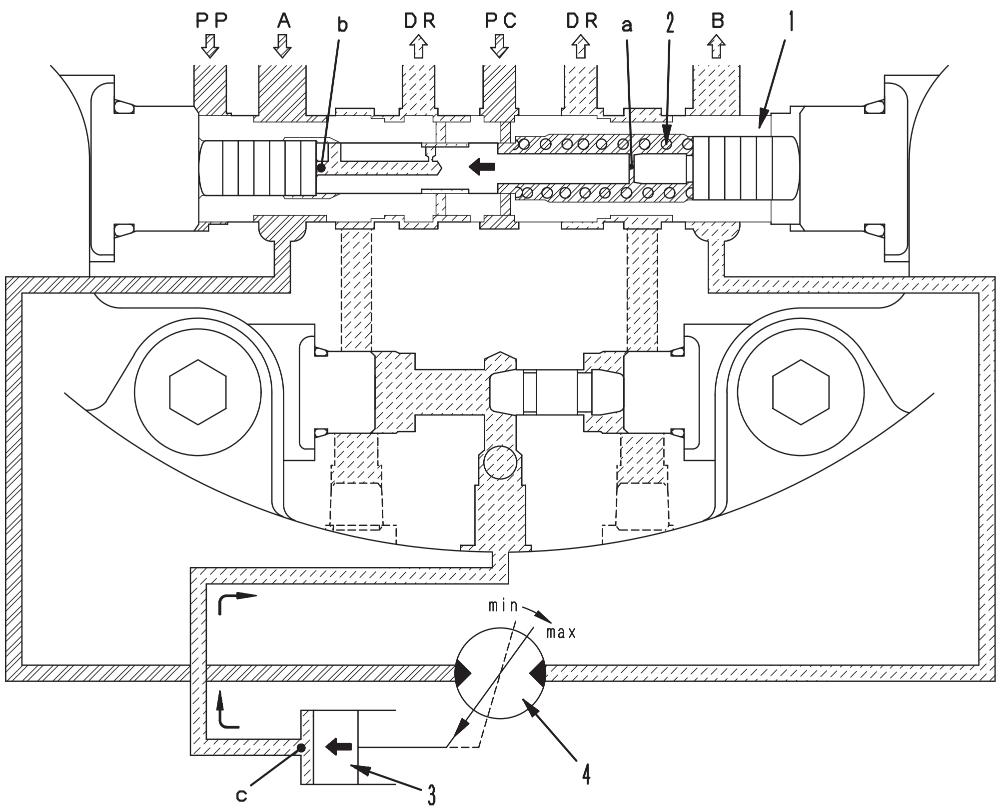
- When 2nd travel speed selection solenoid valve (1) is turned ON, the pilot pressure from the control pump flows to port **PP**.
- Automatic speed changing valve (2) compresses spring (3) and moves up to open the circuit to control chamber **a**.
- The main hydraulic oil from the control valve flows from automatic speed changing valve (2) through check valve (4) to control chamber **a** to press control piston (5) to the left.
- Accordingly, swash plate (6) leans around ball (8) against center spring (7) toward the minimum swash plate angle side and the motor capacity becomes minimum and the travel speed increases.

★ The automatic travel speed changing function works only while the travel speed selector switch is set in the high speed position.
See AUTOMATIC SPEED CHANGING VALVE.

★ While the arm crane (if equipped) is used, the travel speed is kept low.

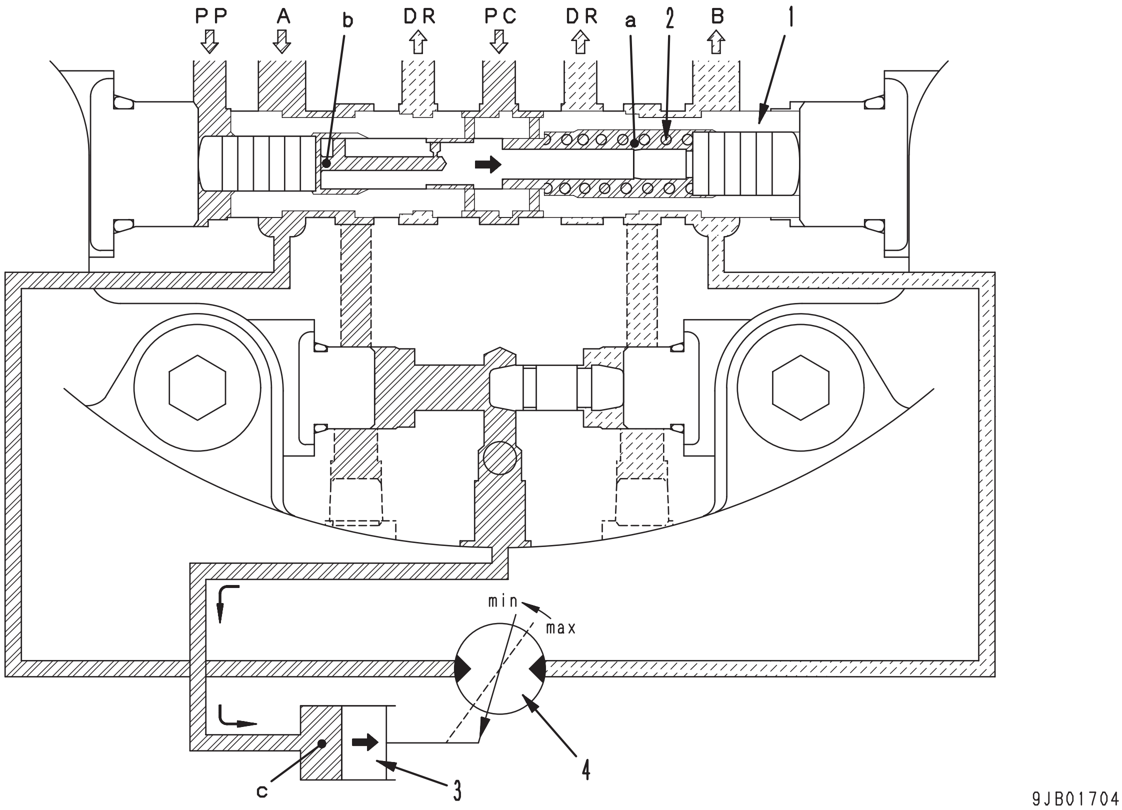
OPERATION OF AUTOMATIC SPEED CHANGING VALVE

Automatic change of travel speed from high speed (High) to low speed (Low)



- While the travel speed selector switch is set in the high speed position, motor drive pressure (PC) is led into chambers **a** and **b** of automatic speed changing valve (1).
- If motor drive pressure (PC) rises, the total of force F1 generated by the difference of the pressure receiving area between chambers **a** and **b** (**a** > **b**) and reaction force F2 of spring (2) becomes larger than force F3 generated by pilot pressure (PP).
  (F3 < F1 + F2)
- As a result, automatic speed changing valve (1) moves to the left and shuts off motor drive pressure (A) flowing into control chamber **c**.
- At the same time, port **DR** opens and the oil in control chamber **c** is drained and control piston (3) moves to the left.
- Accordingly, the swash plate of motor (4) leans toward the maximum swash plate angle side and the travel speed decreases.

Automatic change of travel speed from low speed (Low) to high speed (High)

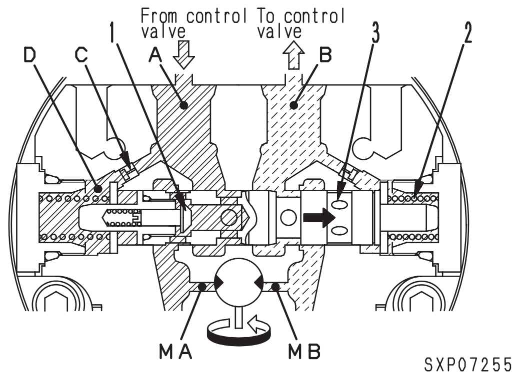


- If the machine travels at low speed while the travel speed selector switch is set in the high speed position, the motor drive pressure (PC) is led to chamber **a** of automatic gear shift valve (1). (Chamber **b** is connected to port **DR**.)
- If the motor drive pressure (PC) lowers, the total of force F1 generated in chamber a by the motor drive pressure (PC) and spring tension F2 becomes less than force F3 generated by the pilot pressure (PP).
  (F3 > F1 + F2)
- As a result, automatic speed changing valve (1) moves to the right and motor drive pressure (A) flows into control chamber **c**.
- At the same time, port **DR** closes and control chamber **c** is filled with oil and control piston (3) moves to the right.
- Accordingly, the swash plate of motor (4) leans toward the minimum swash plate angle side and the travel speed increases.

OPERATION OF COUNTER BALANCE VALVE

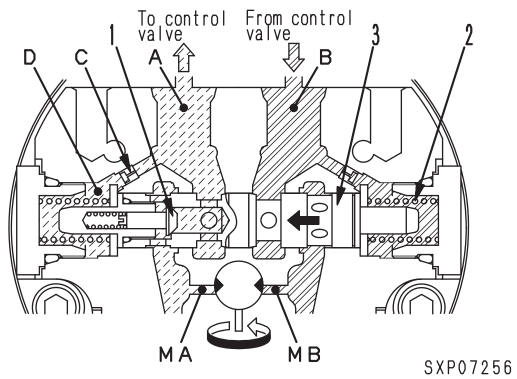
Operation when pressure oil is supplied

- When the travel lever is operated, the pressurized oil from the control valve is supplied to port **A**. It pushes open check valve (1) and flows from motor inlet port **MA** to motor outlet port **MB**.
- The pressurized oil at the supply side flows from orifice **C** to chamber **D**. When the pressure in chamber **D** goes above the spring (2), spool (3) is pushed to the right direction.
  As a result, port **MB** and port **B** are connected, the outlet port side of the motor is opened, and the motor starts to rotate.



Operation when pressure oil is shut off

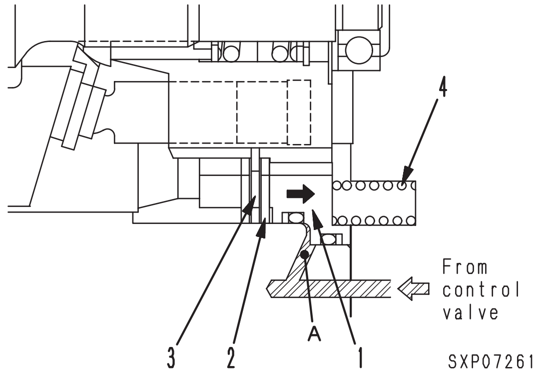
- If the travel lever is returned to the neutral position, the pressure oil from the control valve is shut off and spool (3) is pushed back to the left by the force of spring (2).
- At this time, the oil flows in port **A** through orifice **C** in chamber **D**. The throttle effect of orifice **C** generates back pressure to restrict the speed of spool (3) returning to the left.
- Even if the pressure oil flowing in port **A** is shut off, the motor continues revolution because of its inertia.
- At this time, the changing speed of spool (3) and the shape of the cut reduce the returning oil gradually to stop the motor smoothly.



OPERATION OF PARKING BRAKE

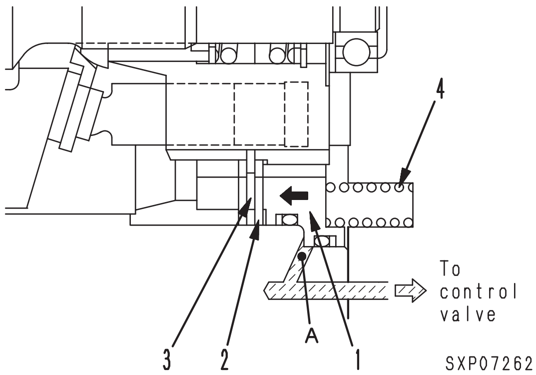
When travel lever is operated

- If the travel lever is operated, the hydraulic oil from the pump flows in chamber **a** of brake piston (1) and pushes brake piston (2) to the right.
  As a result, the pressing force of spring (4) against plate (2) and disc (3) is lost, and then plate (2) and disc (3) are separated and the braking force is released.



When travel lever is in neutral

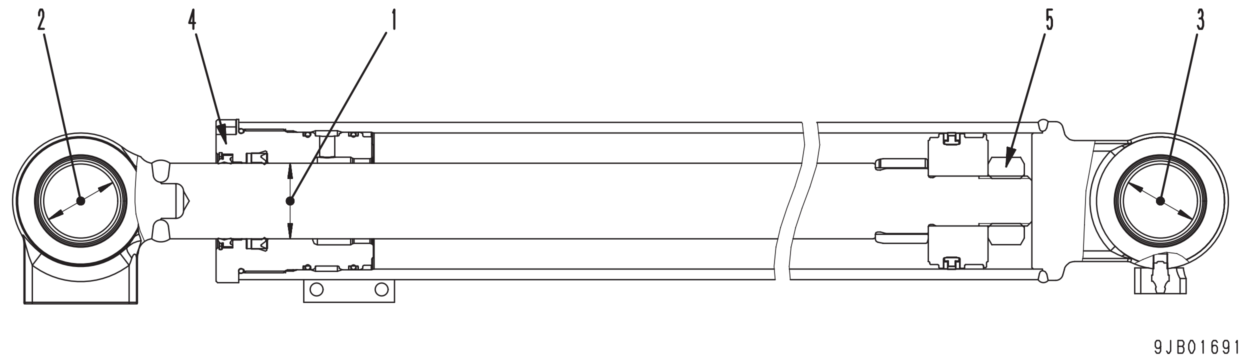
- If the travel lever is set in neutral, the hydraulic oil in chamber **a** of brake piston (1) is shut off and piston (1) is pressed to the left by spring (4).
  As a result, plate (2) and disc (3) are pressed and the brake operates.



HYDRAULIC CYLINDER

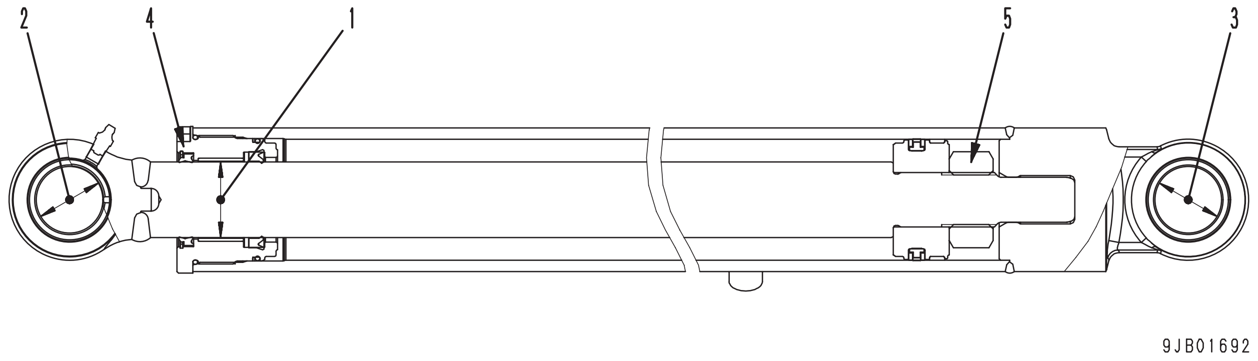
BOOM CYLINDER

★ This diagram shows PC40MR, 50MR.



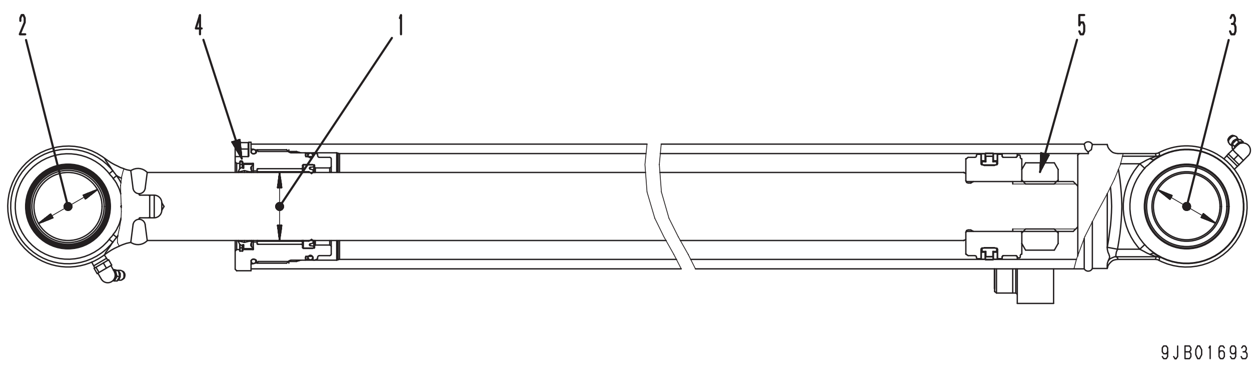
ARM CYLINDER

★ This diagram shows PC40MR.



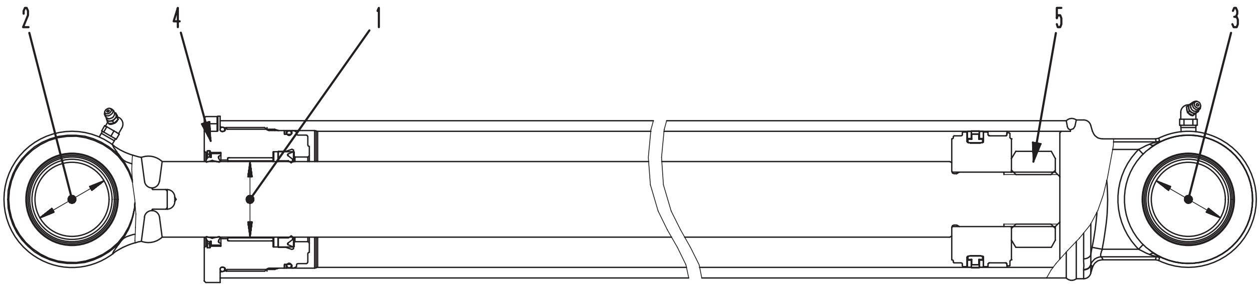
BUCKET CYLINDER

★ This diagram shows PC40MR.



BOOM SWING CYLINDER

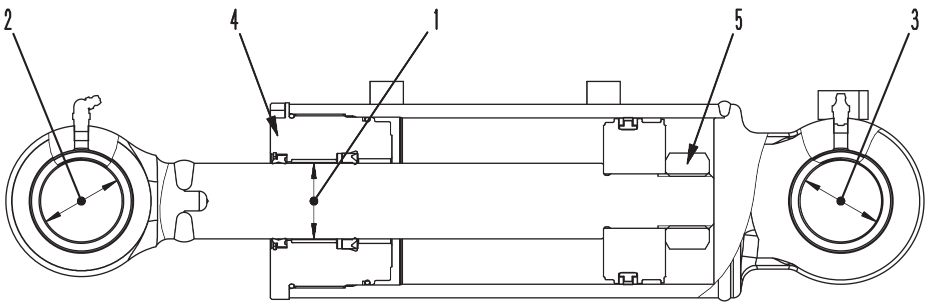
★ This diagram shows PC40MR.



9JB01694

BLADE CYLINDER

★ This diagram shows PC40MR, 50MR.



9JB01695

PC27MR-2

Unit: mm

No.	Check item	Cylinder name	Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	Remedy
1	Clearance between piston rod and bushing	Boom	⌀ 45	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	⌀ 40	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace bushing
		Bucket	⌀ 35	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	
		Boom swing	⌀ 40	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	
		Blade	⌀ 45	– 0.025 – 0.087	+ 0.152 + 0.007	0.031 – 0.239	0.539	
2	Clearance between piston rod supporting shaft and bushing	Boom	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	Replace pin and bushing
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.170 – 0.230	0 – 0.060	0.110 – 0.230	1.0	
		Boom swing	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	
		Boom swing	⌀ 40	– 0.025 – 0.064	+ 0.134 + 0.072	0.097 – 0.198	1.0	
		Blade	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
4	Tightening torque of cylinder head	Boom	569 ± 57.0 Nm {58 ± 5.9 kgm}					Retighten
		Arm	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Bucket	569 ± 57.0 Nm {58 ± 5.8 kgm}					
		Boom swing	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Blade	637 ± 63.5 Nm {65 ± 6.5 kgm}					
5	Tightening torque of cylinder piston	Boom	785 ± 78.5 Nm {80 ± 8.0 kgm} (Width across flats: 46 mm)					
		Arm	912 ± 91.0 Nm {93 ± 9.3 kgm} (Width across flats: 46 mm)					
		Bucket	412 ± 41.0 Nm {42 ± 4.2 kgm} (Width across flats: 36 mm)					
		Boom swing	647 ± 64.5 Nm {66 ± 6.6 kgm} (Width across flats: 41 mm)					
		Blade	1.08 ± 0.11 kNm {110 ± 11.0 kgm} (Width across flats: 50 mm)					

PC30MR-2

Unit: mm

No.	Check item	Criteria						Remedy
		Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	⌀ 45	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	⌀ 40	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace bushing
		Bucket	⌀ 40	– 0.025 – 0.087	+ 0.132 + 0.006	0.031 – 0.219	0.519	
		Boom swing	⌀ 40	– 0.025 – 0.087	+ 0.132 + 0.006	0.031 – 0.219	0.519	
		Blade	⌀ 45	– 0.025 – 0.087	+ 0.152 + 0.007	0.032 – 0.239	0.539	
2	Clearance between piston rod supporting shaft and bushing	Boom	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	Replace pin and bushing
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.170 – 0.230	0 – 0.060	0.110 – 0.230	1.0	
		Boom swing	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	
		Boom swing	⌀ 40	– 0.025 – 0.064	+ 0.134 + 0.072	0.097 – 0.198	1.0	
		Blade	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
4	Tightening torque of cylinder head	Boom	588 ± 59.0 Nm {60 ± 6.0 kgm}					Retighten
		Arm	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Bucket	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Boom swing	588 ± 59.0 Nm {60 ± 6.0 kgm}					
		Blade	637 ± 63.5 Nm {65 ± 6.5 kgm}					
5	Tightening torque of cylinder piston	Boom	912 ± 91.0 Nm {93 ± 9.3 kgm} (Width across flats: 46 mm)					
		Arm	912 ± 91.0 Nm {93 ± 9.3 kgm} (Width across flats: 46 mm)					
		Bucket	785 ± 78.5 Nm {80 ± 8.0 kgm} (Width across flats: 46 mm)					
		Boom swing	647 ± 64.5 Nm {66 ± 6.6 kgm} (Width across flats: 41 mm)					
		Blade	1.08 ± 0.11 kNm {110 ± 11.0 kgm} (Width across flats: 50 mm)					

PC35MR-2

Unit: mm

No.	Check item	Criteria						Remedy
		Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	⌀ 45	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	⌀ 45	– 0.025 – 0.087	+ 0.152 + 0.007	0.032 – 0.239	0.539	Replace bushing
		Bucket	⌀ 40	– 0.025 – 0.087	+ 0.132 + 0.006	0.031 – 0.219	0.519	
		Boom swing	⌀ 50	– 0.025 – 0.087	+ 0.164 + 0.007	0.032 – 0.251	0.551	
		Blade	⌀ 45	– 0.025 – 0.087	+ 0.152 + 0.007	0.032 – 0.239	0.539	
2	Clearance between piston rod supporting shaft and bushing	Boom	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	Replace pin and bushing
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.170 – 0.230	0 – 0.060	0.110 – 0.230	1.0	
		Boom swing	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Arm	⌀ 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 35	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	
		Boom swing	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
4	Tightening torque of cylinder head	Boom	588 ± 59.0 Nm {60 ± 6.0 kgm}					Retighten
		Arm	785 ± 78.5 Nm {80 ± 8.0 kgm}					
		Bucket	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Boom swing	735 ± 73.5 Nm {75 ± 7.5 kgm}					
		Blade	735 ± 73.5 Nm {75 ± 7.5 kgm}					
5	Tightening torque of cylinder piston	Boom	912 ± 91.0 Nm {93 ± 9.3 kgm} (Width across flats: 46 mm)					
		Arm	1.25 ± 0.13 kNm {127 ± 12.7 kgm} (Width across flats: 50 mm)					
		Bucket	785 ± 78.5 Nm {80 ± 8.0 kgm} (Width across flats: 46 mm)					
		Boom swing	1.42 ± 0.14 kNm {145 ± 14.5 kgm} (Width across flats: 55 mm)					
		Blade	1.08 ± 0.11 kNm {110 ± 11.0 kgm} (Width across flats: 50 mm)					

PC40MR-2

Unit: mm

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Check item</th><th colspan="6">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><th rowspan="2">Cylinder name</th><th rowspan="2">Standard size</th><th colspan="2">Tolerance</th><th rowspan="2">Standard clearance</th><th rowspan="2">Clearance limit</th></tr>
<tr><td></td><td></td><th>Shaft</th><th>Hole</th><td></td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Clearance between piston rod and bushing</td><td>Boom</td><td>ø 50</td><td>– 0.025
– 0.087</td><td>+ 0.039
0</td><td>0.025 – 0.126</td><td>0.426</td><td>Replace cylinder head</td></tr>
<tr><td>Arm</td><td>ø 50</td><td>– 0.025
– 0.087</td><td>+ 0.164
+ 0.007</td><td>0.032 – 0.251</td><td>0.551</td><td rowspan="4">Replace bushing</td></tr>
<tr><td>Bucket</td><td>ø 45</td><td>– 0.025
– 0.087</td><td>+ 0.152
+ 0.007</td><td>0.032 – 0.239</td><td>0.539</td></tr>
<tr><td>Boom swing</td><td>ø 50</td><td>– 0.025
– 0.087</td><td>+ 0.164
+ 0.007</td><td>0.032 – 0.251</td><td>0.551</td></tr>
<tr><td>Blade</td><td>ø 50</td><td>– 0.025
– 0.087</td><td>+ 0.164
+ 0.007</td><td>0.032 – 0.251</td><td>0.551</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Clearance between piston rod supporting shaft and bushing</td><td>Boom</td><td>ø 50</td><td>– 0.147
– 0.209</td><td>+ 0.142
+ 0.080</td><td>0.227 – 0.351</td><td>1.0</td><td rowspan="10">Replace pin and bushing</td></tr>
<tr><td>Arm</td><td>ø 45</td><td>– 0.025
– 0.064</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.206</td><td>1.0</td></tr>
<tr><td>Bucket</td><td>ø 45</td><td>– 0.170
– 0.230</td><td>– 0.011
– 0.065</td><td>0.105 – 0.219</td><td>1.0</td></tr>
<tr><td>Boom swing</td><td>ø 50</td><td>– 0.025
– 0.064</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.206</td><td>1.0</td></tr>
<tr><td>Blade</td><td>ø 55</td><td>– 0.030
– 0.076</td><td>+ 0.174
+ 0.100</td><td>0.130 – 0.250</td><td>1.0</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Clearance between cylinder bottom supporting shaft and bushing</td><td>Boom</td><td>ø 50</td><td>– 0.025
– 0.087</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.229</td><td>1.0</td></tr>
<tr><td>Arm</td><td>ø 45</td><td>– 0.025
– 0.087</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.229</td><td>1.0</td></tr>
<tr><td>Bucket</td><td>ø 45</td><td>– 0.025
– 0.064</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.206</td><td>1.0</td></tr>
<tr><td>Boom swing</td><td>ø 50</td><td>– 0.025
– 0.064</td><td>+ 0.142
+ 0.080</td><td>0.105 – 0.206</td><td>1.0</td></tr>
<tr><td>Blade</td><td>ø 55</td><td>– 0.030
– 0.076</td><td>+ 0.174
+ 0.100</td><td>0.130 – 0.250</td><td>1.0</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Tightening torque of cylinder head</td><td>Boom</td><td colspan="5">735 ± 73.5 Nm {75 ± 7.5 kgm}</td><td rowspan="10">Retighten</td></tr>
<tr><td>Arm</td><td colspan="5">785 ± 78.5 Nm {80 ± 8.0 kgm}</td></tr>
<tr><td>Bucket</td><td colspan="5">785 ± 78.5 Nm {80 ± 8.0 kgm}</td></tr>
<tr><td>Boom swing</td><td colspan="5">677 ± 67.5 Nm {69 ± 6.9 kgm}</td></tr>
<tr><td>Blade</td><td colspan="5">931 ± 93.0 Nm {95 ± 9.5 kgm}</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Tightening torque of cylinder piston</td><td>Boom</td><td colspan="5">1.25 ± 0.13 kNm {127 ± 12.7 kgm} (Width across flats: 50 mm)</td></tr>
<tr><td>Arm</td><td colspan="5">1.67 ± 0.17 kNm {170 ± 17.0 kgm} (Width across flats: 55 mm)</td></tr>
<tr><td>Bucket</td><td colspan="5">1.08 ± 0.11 kNm {110 ± 11.0 kgm} (Width across flats: 50 mm)</td></tr>
<tr><td>Boom swing</td><td colspan="5">1.42 ± 0.14 kNm {145 ± 14.5 kgm} (Width across flats: 55 mm)</td></tr>
<tr><td>Blade</td><td colspan="5">1.42 ± 0.14 kNm {145 ± 14.5 kgm} (Width across flats: 55 mm)</td></tr>
</table>

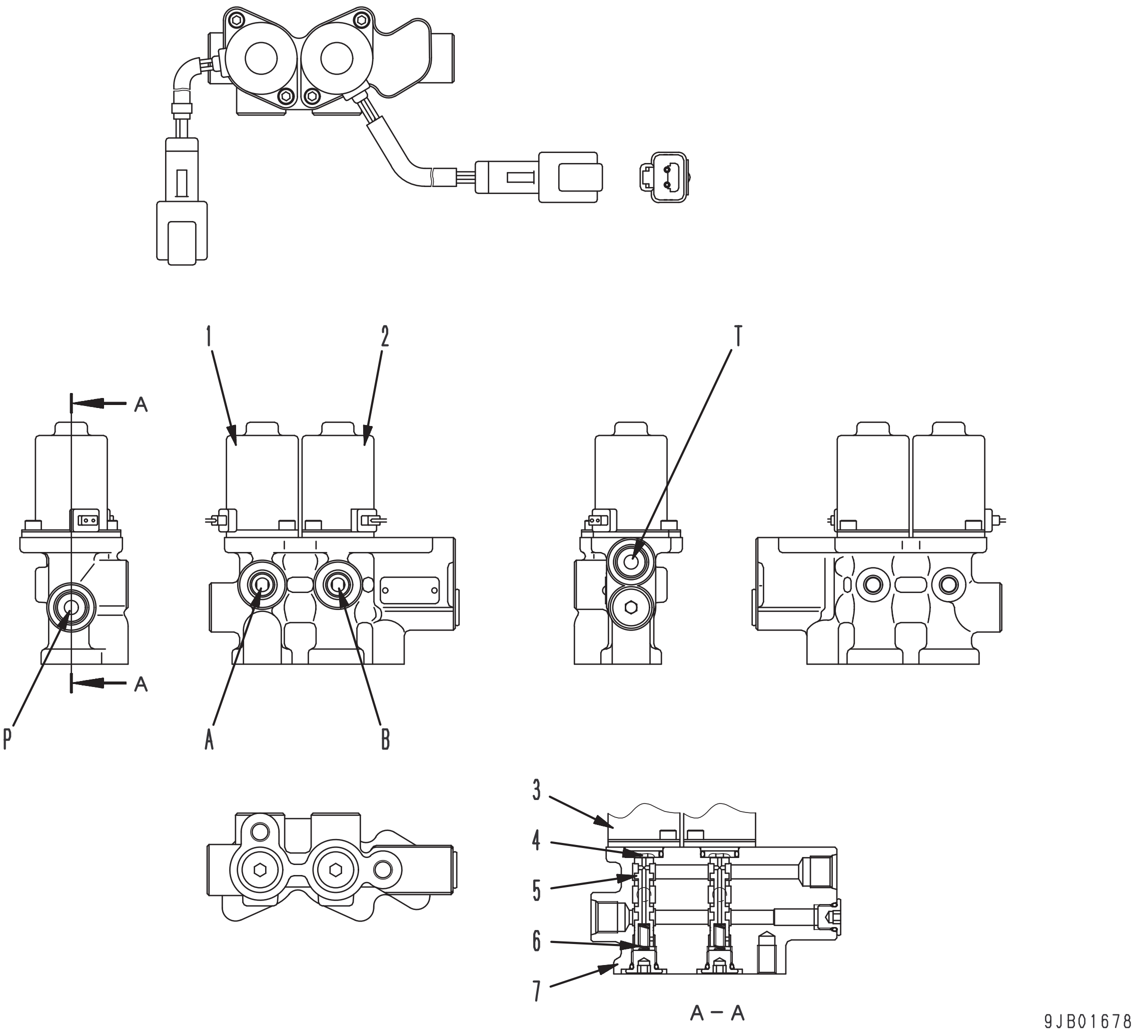
PC50MR-2

Unit: mm

No.	Check item	Cylinder name	Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	Remedy
1	Clearance between piston rod and bushing	Boom	⌀ 50	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	⌀ 50	– 0.025 – 0.087	+ 0.164 + 0.007	0.032 – 0.251	0.539	Replace bushing
		Bucket	⌀ 50	– 0.025 – 0.087	+ 0.164 + 0.007	0.032 – 0.251	0.519	
		Boom swing	⌀ 50	– 0.025 – 0.087	+ 0.164 + 0.007	0.032 – 0.251	0.551	
		Blade	⌀ 50	– 0.025 – 0.087	+ 0.164 + 0.007	0.032 – 0.251	0.539	
2	Clearance between piston rod supporting shaft and bushing	Boom	⌀ 50	– 0.147 – 0.209	+ 0.142 + 0.080	0.227 – 0.351	1.0	Replace pin and bushing
		Arm	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Bucket	⌀ 45	– 0.170 – 0.230	– 0.011 – 0.065	0.105 – 0.219	1.0	
		Boom swing	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 55	– 0.030 – 0.076	+ 0.174 + 0.100	0.130 – 0.250	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	⌀ 50	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	
		Arm	⌀ 45	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	
		Bucket	⌀ 45	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Boom swing	⌀ 50	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		Blade	⌀ 55	– 0.030 – 0.076	+ 0.174 + 0.100	0.130 – 0.250	1.0	
4	Tightening torque of cylinder head	Boom	735 ± 73.5 Nm {75 ± 7.5 kgm}					Retighten
		Arm	961 ± 96.0 Nm {98 ± 9.8 kgm}					
		Bucket	863 ± 86.5 Nm {88 ± 8.8 kgm}					
		Boom swing	735 ± 73.5 Nm {75 ± 7.5 kgm}					
		Blade	931 ± 93.0 Nm {95 ± 9.5 kgm}					
5	Tightening torque of cylinder piston	Boom	1.25 ± 0.13 kNm {127 ± 12.7 kgm} (Width across flats: 50 mm)					
		Arm	1.67 ± 0.17 kNm {170 ± 17.0 kgm} (Width across flats: 55 mm)					
		Bucket	1.08 ± 0.11 kNm {110 ± 11.0 kgm} (Width across flats: 50 mm)					
		Boom swing	1.42 ± 0.14 kNm {145 ± 14.5 kgm} (Width across flats: 55 mm)					
		Blade	1.42 ± 0.14 kNm {145 ± 14.5 kgm} (Width across flats: 55 mm)					

SOLENOID VALVE

PC27MR, 30MR-2



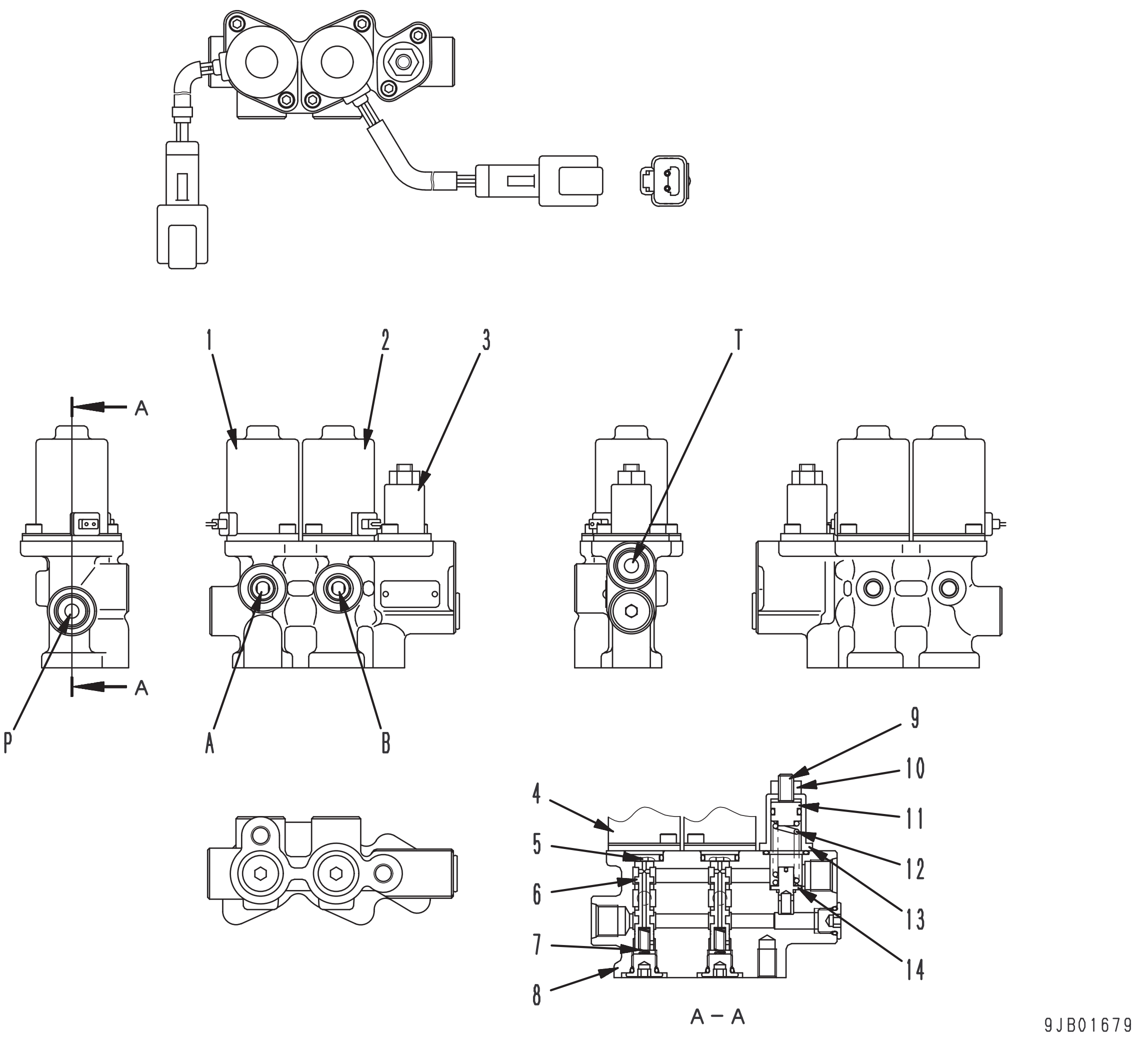
A : To PPC valve
B : To 2nd travel speed selector valve
P : From hydraulic pump
T : To hydraulic tank

1. PPC lock solenoid valve
2. 2nd travel speed selector solenoid valve

Solenoid valve

3. Coil (ON/OFF type)
4. Push pin
5. Valve spool
6. Return spring
7. Valve body

PC35MR, 40MR, 50MR-2



A : To PPC valve
B : To 2nd travel speed selector valve
P : From hydraulic pump
T : To hydraulic tank

1. PPC lock solenoid valve
2. 2nd travel speed selector solenoid valve
3. Control relief valve

Solenoid valve

4. Coil (ON/OFF type)
5. Push pin
6. Valve spool
7. Return spring
8. Valve body

Control relief valve

9. Adjustment screw
10. Locknut
11. Plug
12. Return spring
13. Cover
14. Plunger

2ND TRAVEL SPEED SELECTOR SOLENOID VALVE
PPC LOCK SOLENOID VALVE

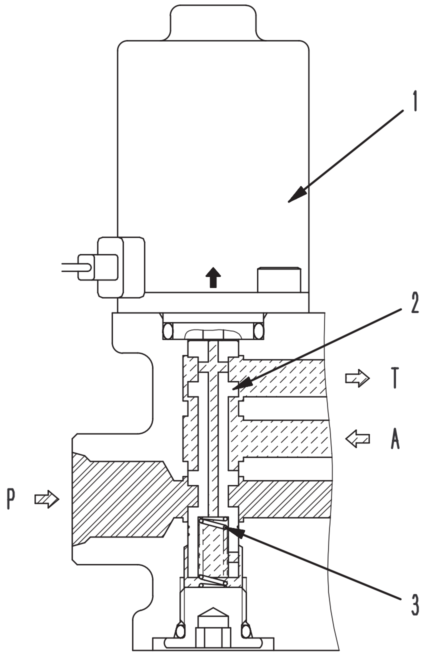
OPERATION

When solenoid is turned OFF
(When circuit is shut off)

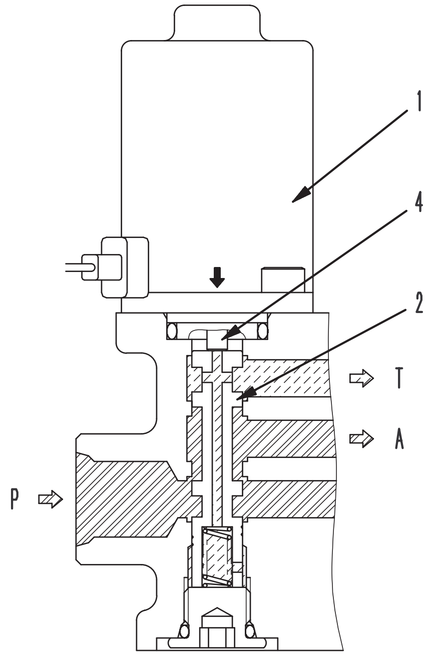
- While the signal current is not flowing from the PPC lock solenoid valve or travel speed selector switch, solenoid (1) is turned OFF.
  Accordingly, spool (2) is pressed up by spring (3).
- As a result, ports **P** and **A** are shut off from each other and the pilot pressure does not flow into the actuator.
  At the same time, the oil from the actuator flows through ports **A** and **T** to the hydraulic tank.

When solenoid is turned ON
(When circuit is connected)

- While the signal current is flowing from the PPC lock solenoid valve or travel speed selector switch to solenoid (1), solenoid (1) is turned ON.
- Accordingly, spool (2) is pressed down by push pin (4).
- As a result, ports **P** and **A** are connected to each other and the pilot pressure flows into the actuator.
  At the same time, the port **T** is closed and the oil does not flow to the hydraulic tank.



9JB01680

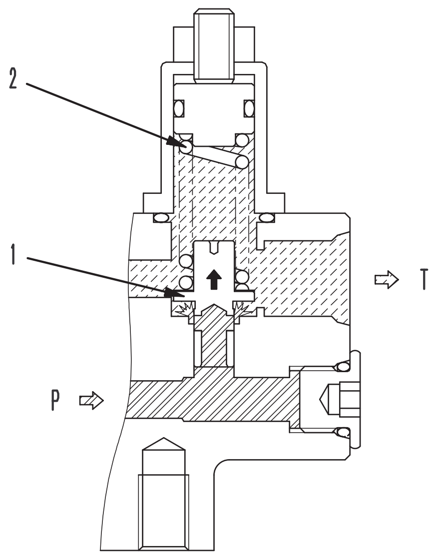


9JB01681

CONTROL RELIEF VALVE
PC35MR, 40MR, 50MR-2

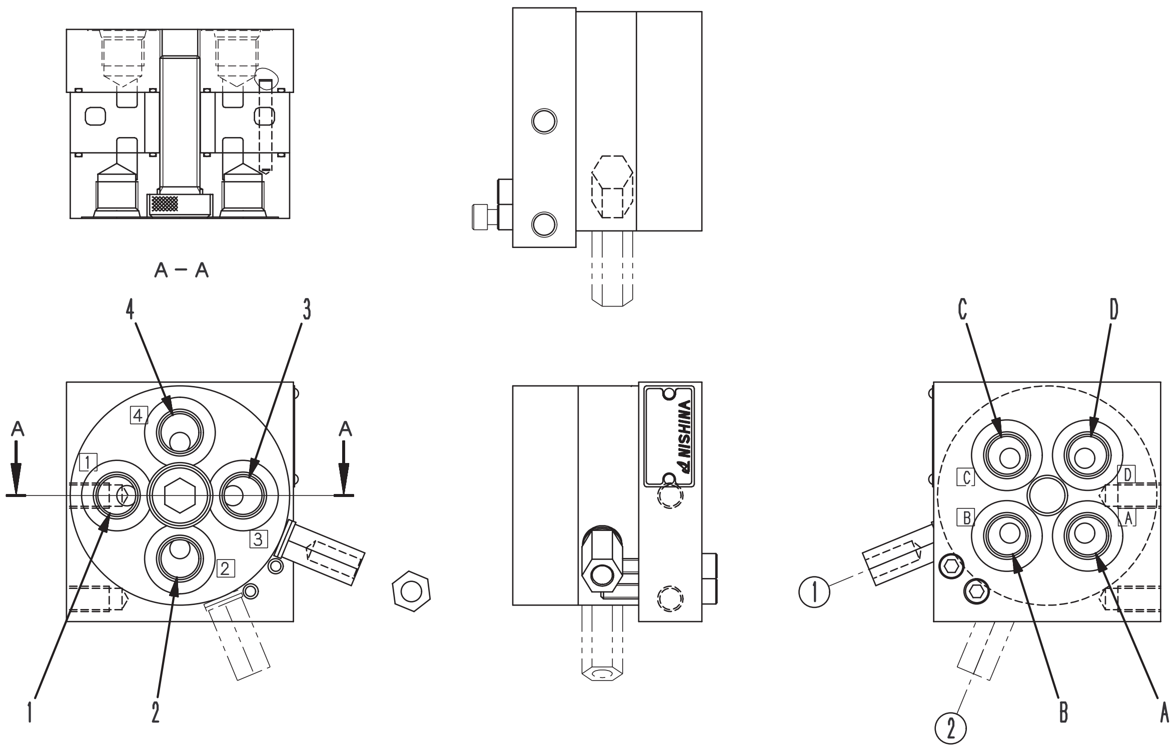
OPERATION

- If the oil pressure from the hydraulic pump increases, the oil in port **P** pushes plunger (1) and its reaction force compresses spring (2) and moves up plunger (1), and then the oil is relieved through ports **P** and **T**.
  Set pressure: 3.14 MPa {32 kg/cm^2}



9JB01682

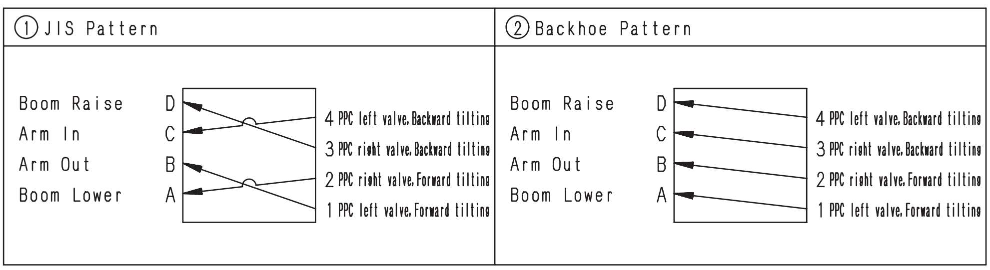
MULTI-CONTROL VALVE



9JB01750

(1) JIS pattern (2) BACKHOE pattern

Operation pattern selection drawing (The port names correspond to the symbols in the drawing).



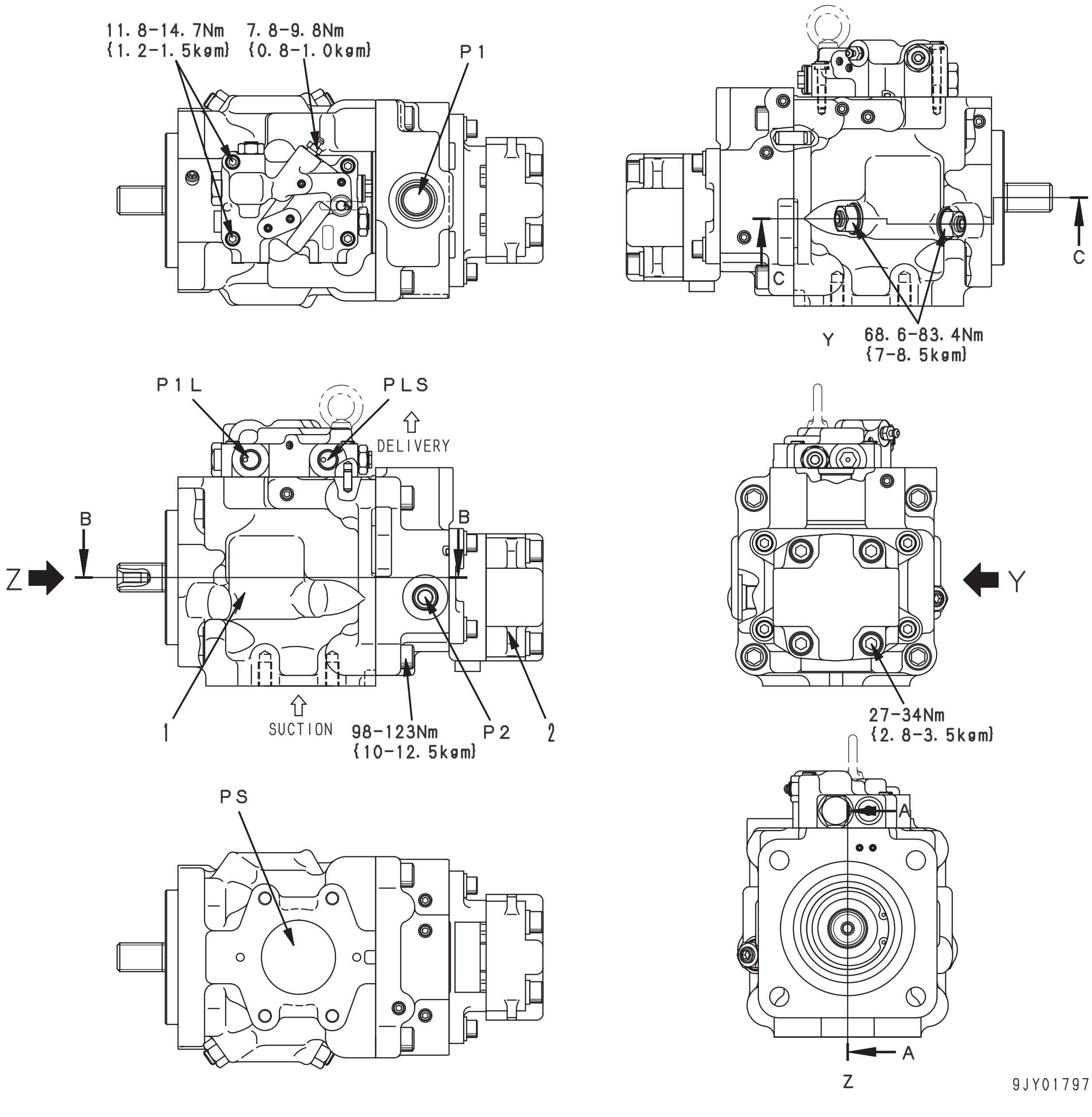
9JB01751

HYDRAULIC PUMP

PC27MR, 30MR-2

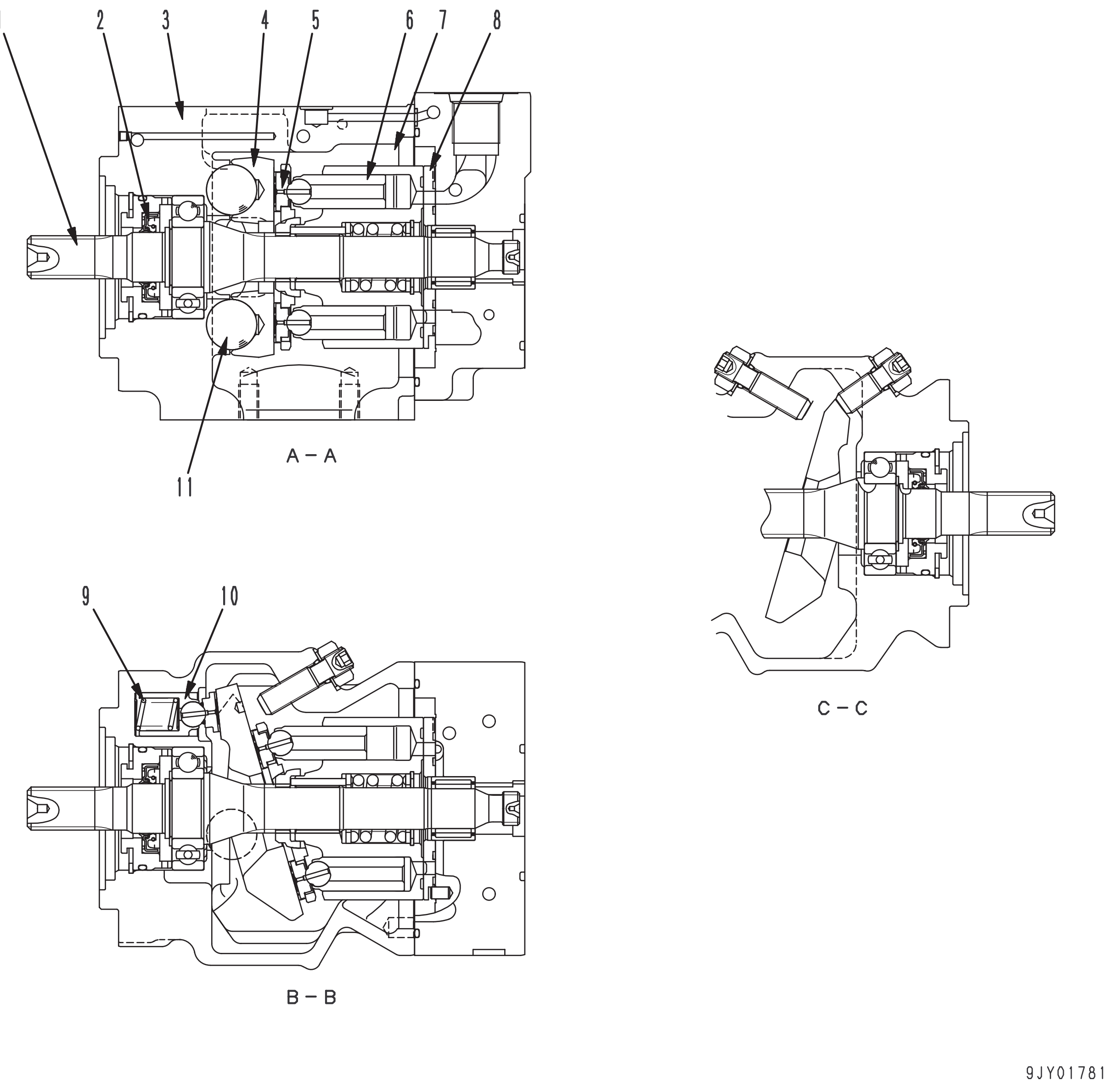
Type: LPV30 + SBR8.5

MAIN PUMP

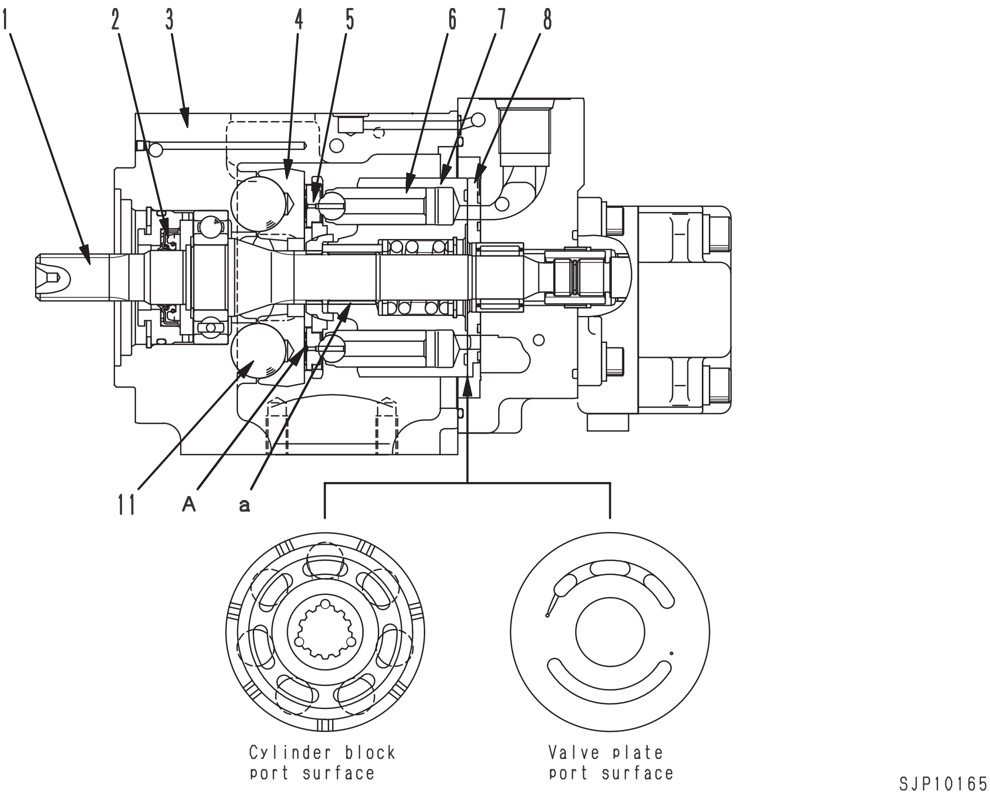


P1 : Main pump discharge
P2 : Gear pump discharge
P1L : Pump pressure inlet
PS : Pump suction
PLS : Control valve LS pressure inlet

1. Main pump (piston pump)
2. Gear pump



1. Shaft
2. Oil seal
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Spring (In servo piston)
10. Servo piston
11. Ball (For supporting rocker cam)



FUNCTION

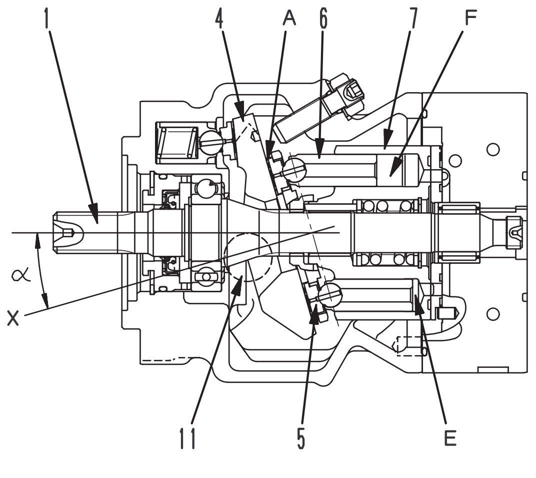
- The engine rotation and torque transmitted to the pump shaft is converted into hydraulic energy, and pressurized oil is discharged according the load.
- It is possible to change the delivery amount by changing the swash angle.

STRUCTURE

- Cylinder block (7) is supported to shaft (1) by spline **a**, and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface **A**. Shoe (5) is kept pressed against the flat surface **A** and it slides circularly on flat surface **A**. Rocker cam (4) slides around ball (11).
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level. The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).
- Hole number of cylinder block (7) is an odd number. So, it is suited to groove of valve plate (8).

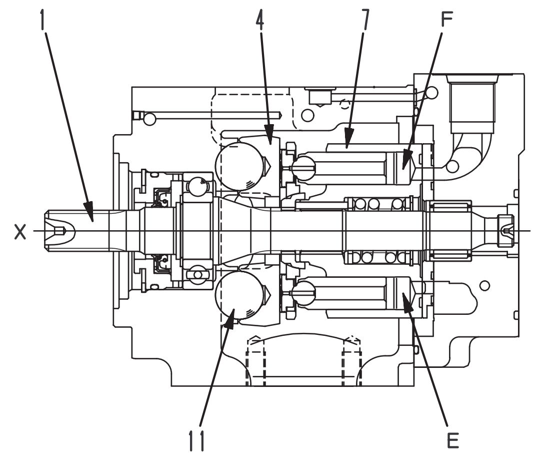
OPERATIONS

- Shaft (1) and cylinder block (7) rotate together and shoe (5) slides on the flat surface **A**. Since the rocker cam (4) leans around ball (11) at this time, the angle "α" between the center line **X** of rocker cam (4) and axis of cylinder block (7) changes. The angle "α" is called the swash plate angle.
- When the center line **X** of the rocker cam (4) maintains the swash plate angle "α" in relation to the axial direction of the cylinder block (7), the flat surface **A** acts as a cam for the shoe (5).
- By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between capacities **E** and **F**, then suction and discharge of oil for the amount of this difference **F**-**E** will be carried out.
- In other words, oil is discharged as the capacity of the chamber **E** decreases when the cylinder block (7) rotates.
  In the mean time, the capacity of the chamber **F** increases, and the oil is sucked at this process.
  (The figure shows the state of the pump when suction of the chamber **F** and discharge of the chamber **E** have completed.)



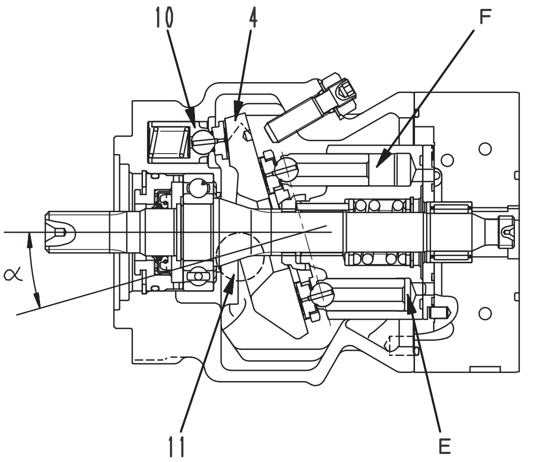
9JY01783

- When the center line **X** of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of **E** and **F** inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of oil. (In actual fact, the swash plate angle never becomes 0.)
- In other words, discharge amount of the pump is directly proportional to the swash plate angle "α".



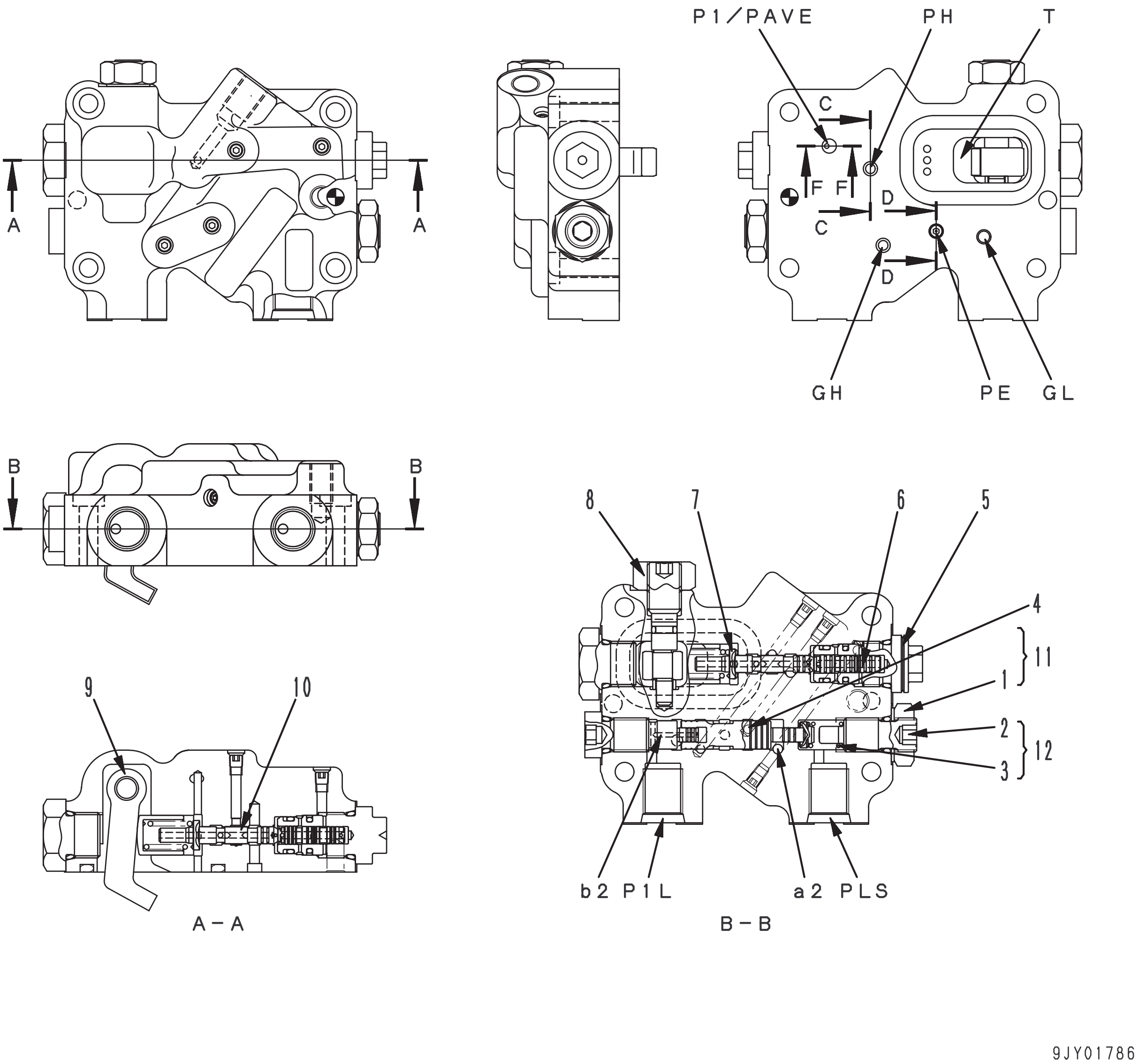
9JY01784

- As the swash plate angle "α" becomes larger, difference between the capacities **E** and **F** becomes larger, so the discharge amount **Q** increases.
  The swash plate angle "α" is changed by the servo piston (10).
- Servo piston (10) is reciprocated straight by the signal pressure of the PC and LS valves. This reciprocation is transferred to rocker cam (4). Rocker cam (4) supported on ball (11) rocks around ball (11).
- The output pressure **PEN** of the LS valve is applied to the pressure chamber of servo piston (10).
- As output pressure **PEN** rises, rocker cam (4) moves to reduce the swash plate angle "α", so the discharge amount **Q** decreases.



9JY01785

VALVE ASSEMBLY



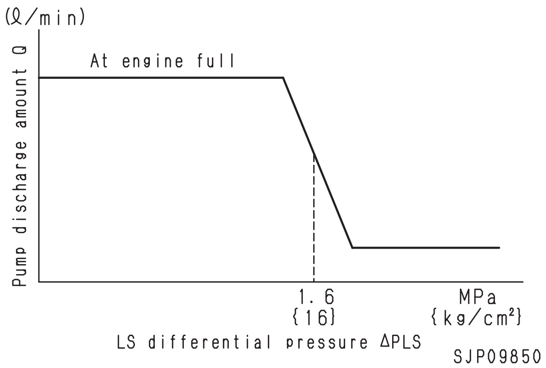
T : Drain
GH : Gear pump HI signal (a2)
GL : Gear pump LO signal (b2)
P1 : Pump signal pressure
PE : Control piston pressure
PH : Pump shuttle pressure (Pump pressure)
P1L : Pump pressure input
PLS : LS pressure input
PAVE : Pump average pressure (Pump pressure)

1. Locknut
2. Plug
3. Spring
4. Spool
5. Sleeve
6. Piston
7. Seat
8. Plug
9. Lever
10. Spool
11. PC valve
12. LS valve

FUNCTION

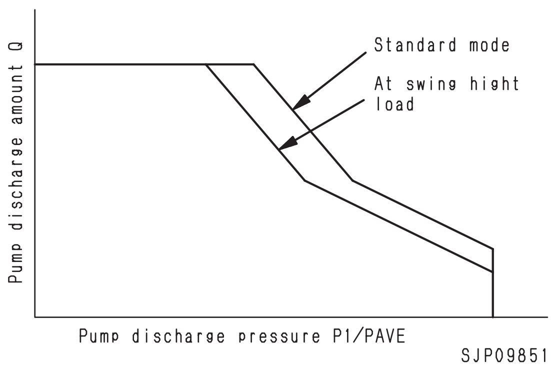
1. LS valve

- The LS valve controls the discharge of the pump according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve calculates the demand flow for the actuator from differential pressure Δ**PLS** between pump discharge pressure **P1L** and control valve outlet pressure **PLS**, and controls pump discharge **Q**.
  (**P1L** is called the pump discharge pressure, **PLS** called the LS pressure, and Δ**PLS** called the LS differential pressure.)
- That is, the pump discharge is controlled according to the demand flow for the actuator by the following method; The pressure loss made when the oil flows through the opening of the control valve spool (LS differential pressure Δ**PLS**) is sensed and pump discharge **Q** is so controlled that the pressure loss will be constant.



2. PC valve

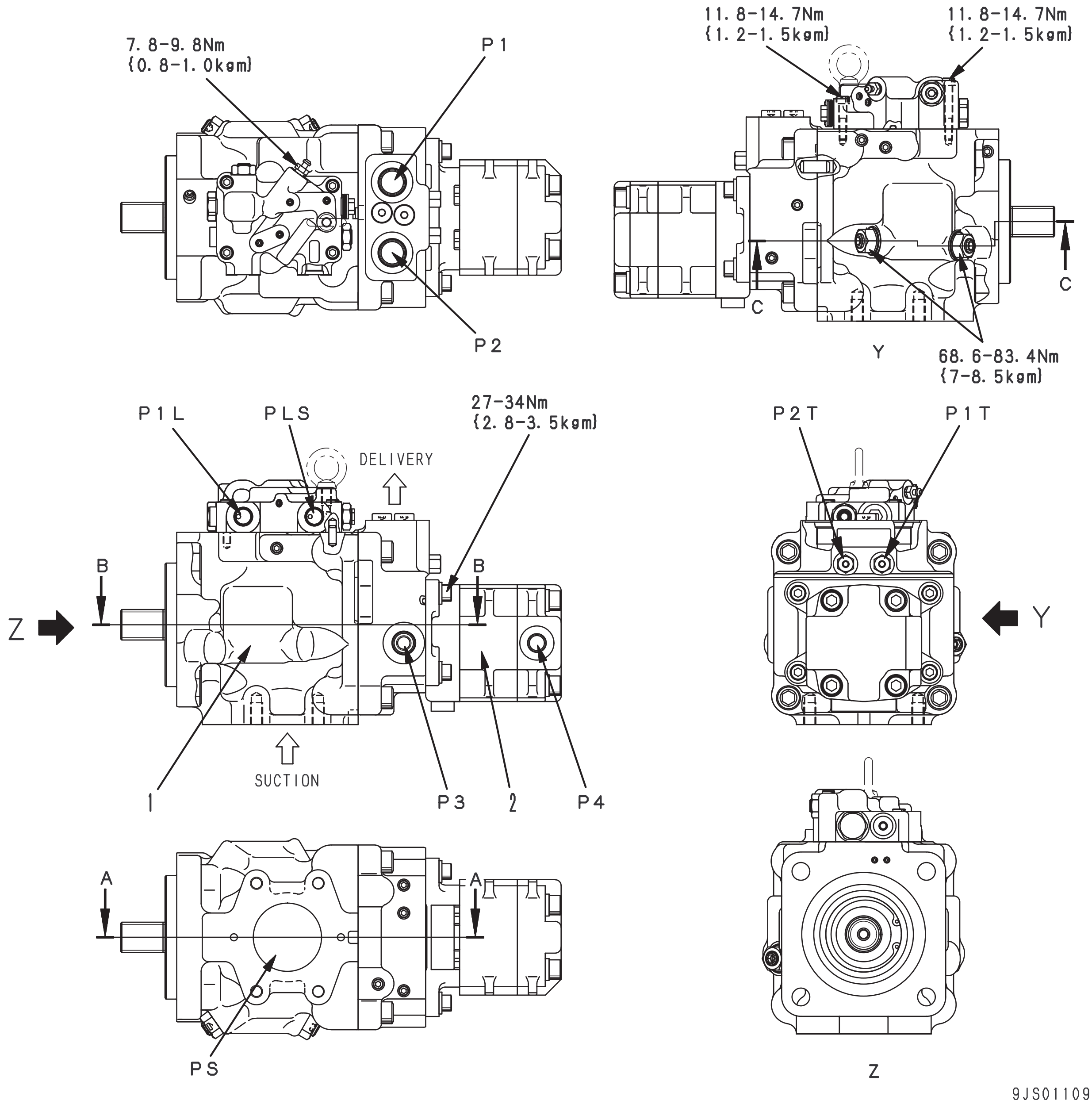
- When pump discharge pressure **P1/PAVE** rises, the stroke of the control valve spool is increased and the opening area is increased and pump discharge **Q** is increased. At this time, the PC valve limits pump discharge **Q** according to discharge pressure **P1/PAVE** so that the pump absorption horsepower will not exceed the engine horsepower. In other words, the PC valve performs approximate constant-horsepower control.
- That is, if the load on the actuator is increased and pump discharge pressure **P1/PAVE** rises during operation, the PC valve reduces pump discharge **Q**. If the pump discharge pressure lowers, the PC valve increases pump discharge **Q**.
- The relationship between pump discharge pressure **P1/PAVE** and pump discharge **Q** is shown below.
- When the machine swings, since the swing pump and main pump are installed tandem, the torque absorbed in the main pump is lowered by the part absorbed in the swing pump.
- When the swing pump operates, the total of the main pump absorption torque and swing pump absorption torque is the total absorption torque (100%)



PC35MR-2

Type: LPD25 + 25 + SBR8.5 + 5

MAIN PUMP



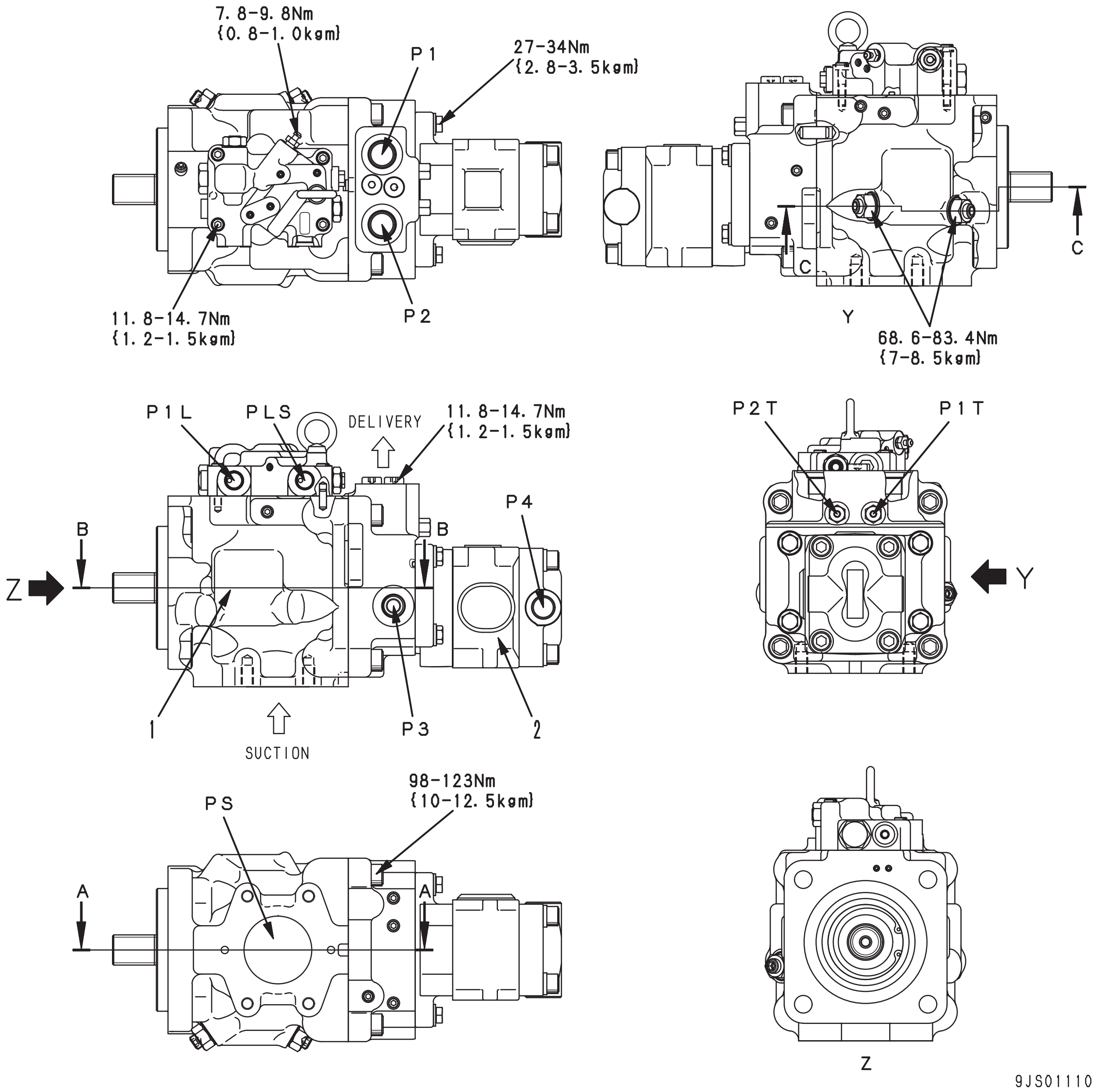
P1 : Pump discharge
P2 : Pump discharge
P3 : Gear pump discharge
P4 : Pilot pump pressure output
PS : Pump suction
P1L : Pump pressure input
P1T : Travel deviation adjustment orifice
P2T : Travel deviation adjustment orifice
PLS : LS pressure input

1. Main pump (Piston pump)
2. Gear pump

PC40MR, 50MR-2

Type: LPD25 + 25 + DNP21 – 14.1 + 5.2

MAIN PUMP



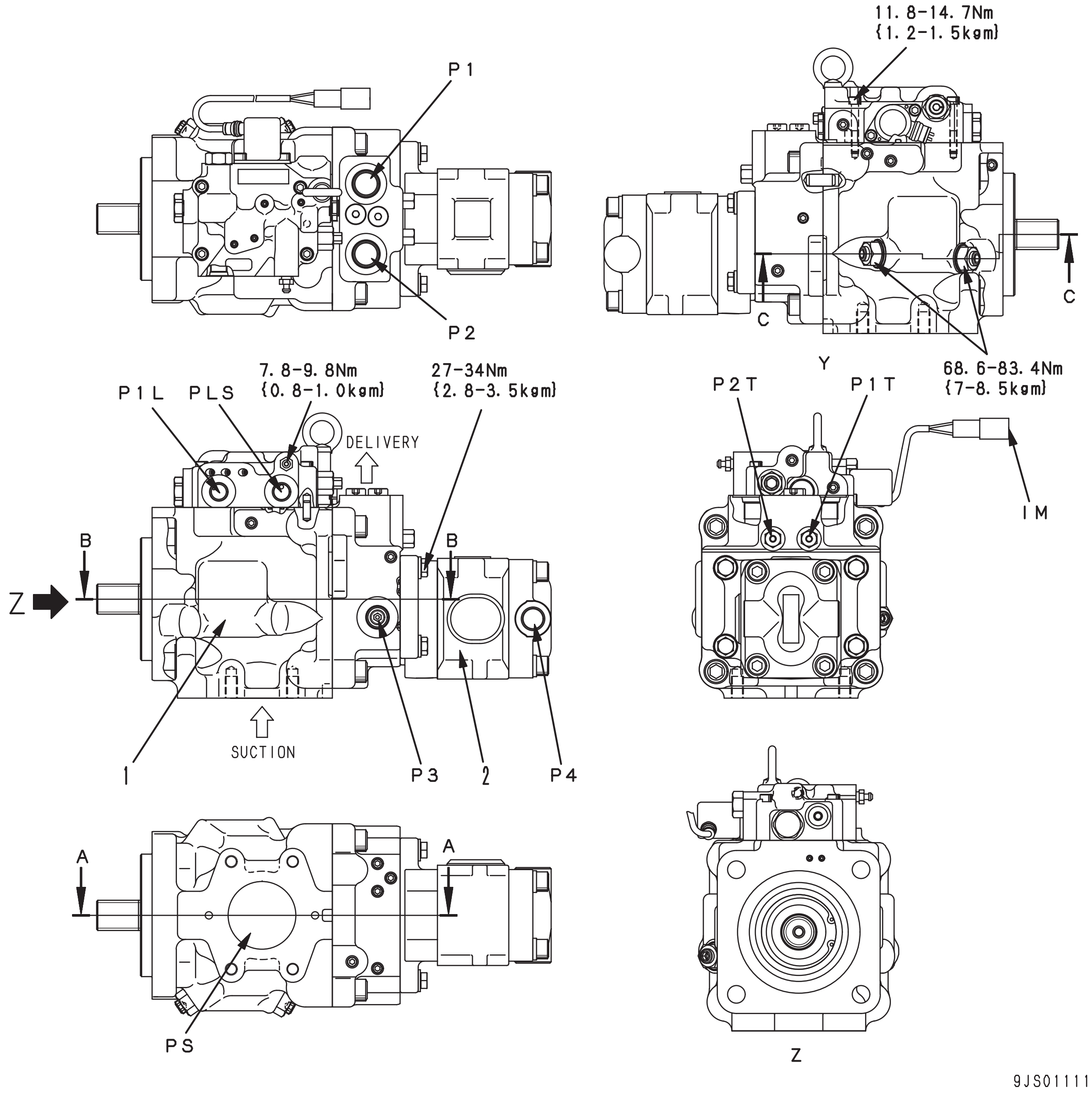
P1 : Pump discharge
P2 : Pump discharge
P3 : Gear pump discharge
P4 : Pilot pump pressure output
PS : Pump suction
P1L : Pump pressure input
P1T : Travel deviation adjustment orifice
P2T : Travel deviation adjustment orifice
PLS : LS pressure input

1. Main pump (Piston pump)
2. Gear pump

PC40MR, 50MR-2

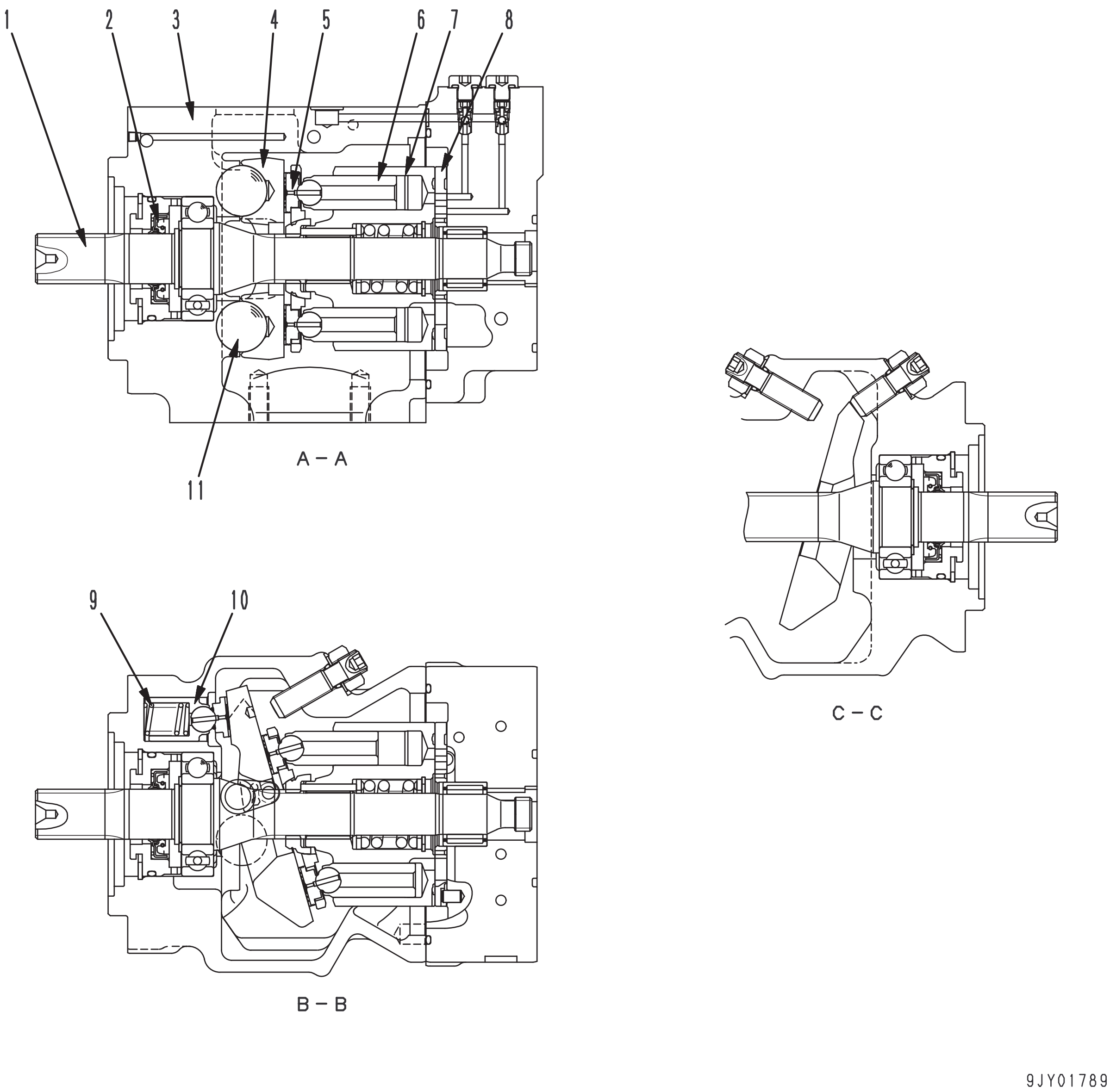
Type: LPD25 + 25 + DNP21 – 14.1 + 5.2

MAIN PUMP (with air conditioner spec.)

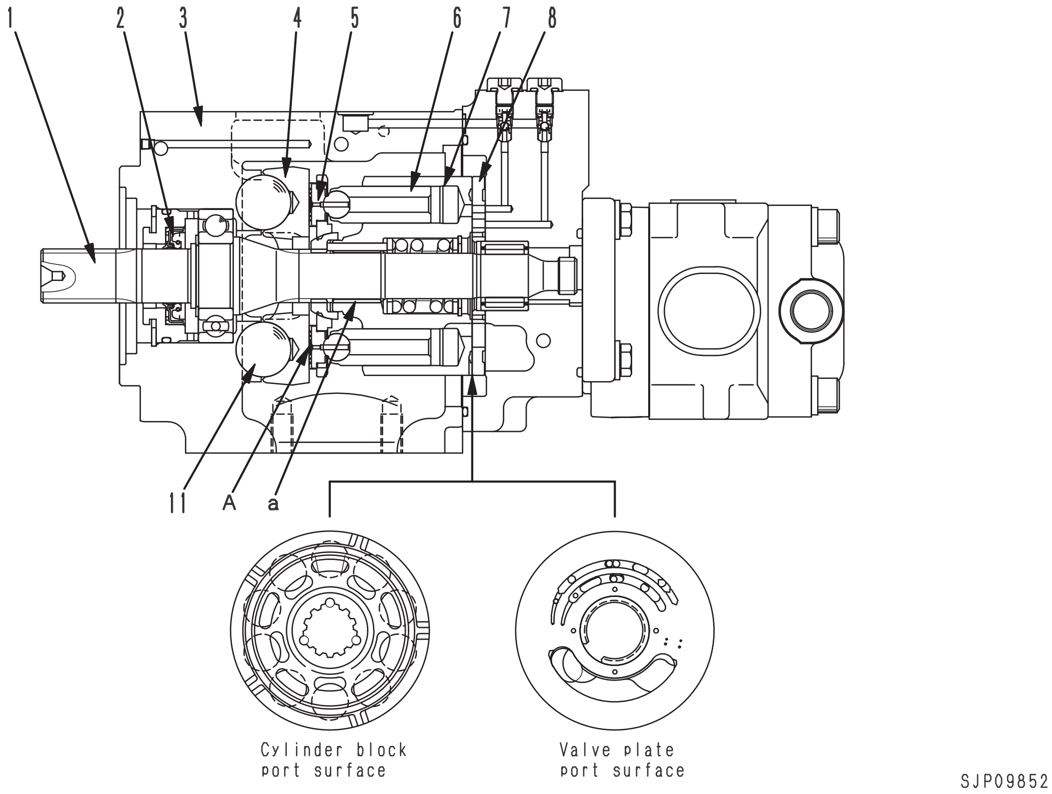


P1 : Pump discharge
P2 : Pump discharge
P3 : Gear pump discharge
P4 : Pilot pump pressure output
PS : Pump suction
P1L : Pump pressure input
P1T : Travel deviation adjustment orifice
P2T : Travel deviation adjustment orifice
PLS : LS pressure input
IM : PC mode selector current

1. Main pump (Piston pump)
2. Gear pump



1. Shaft
2. Oil seal
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Spring (In servo piston)
10. Servo piston
11. Ball (For supporting rocker cam)



FUNCTION

- The engine rotation and torque transmitted to the pump shaft is converted into hydraulic energy, and pressurized oil is discharged according the load.
- It is possible to change the delivery amount by changing the swash angle.
- It have two discharge port and it enable to supply the pressure individually in every one.

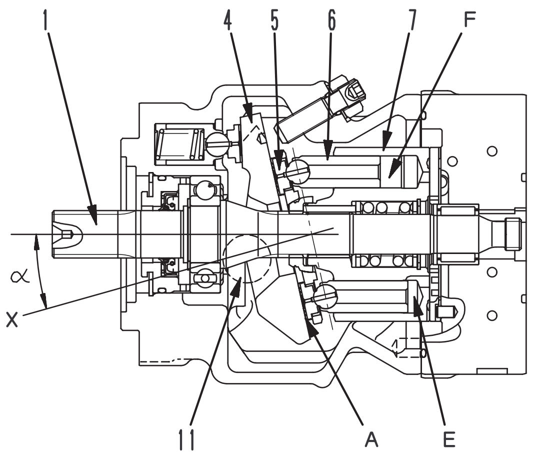
STRUCTURE

- Cylinder block (7) is supported to shaft (1) by spline **a**, and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface **A**. Shoe (5) is kept pressed against the flat surface **A** and it slides circularly on flat surface **A**. Rocker cam (4) slides around ball (11).
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).
  Hole number of cylinder block (7) is an even number. So, it is suited to two groove by valve plate (8) alternately.

OPERATIONS

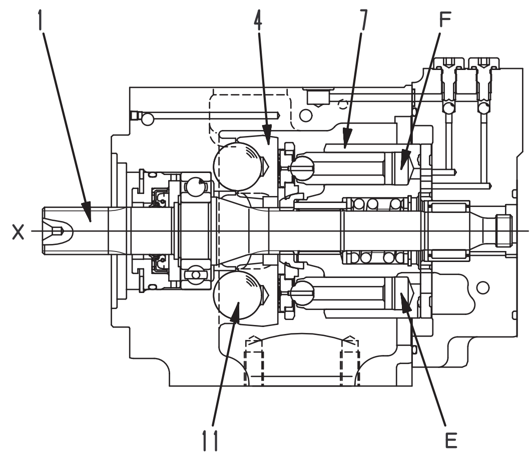
1. Operation of pump

- Shaft (1) and cylinder block (7) rotate together and shoe (5) slides on the flat surface **A**. Since the rocker cam (4) leans around ball (11) at this time, the angle "α" between the center line **X** of rocker cam (4) and axis of cylinder block (7) changes. The angle "α" is called the swash plate angle.
- When the center line **X** of the rocker cam (4) maintains the swash plate angle "α" in relation to the axial direction of the cylinder block (7), the flat surface **A** acts as a cam for the shoe (5).
- By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between capacities **E** and **F**, then suction and discharge of oil for the amount of this difference (**F**-**E**) will be carried out.
- In other words, oil is discharged as the capacity of the chamber **E** decreases when the cylinder block (7) rotates.
  In the mean time, the capacity of the chamber **F** increases, and the oil is sucked at this process.
  (The figure shows the state of the pump when suction of the chamber **F** and discharge of the chamber **E** have completed.)



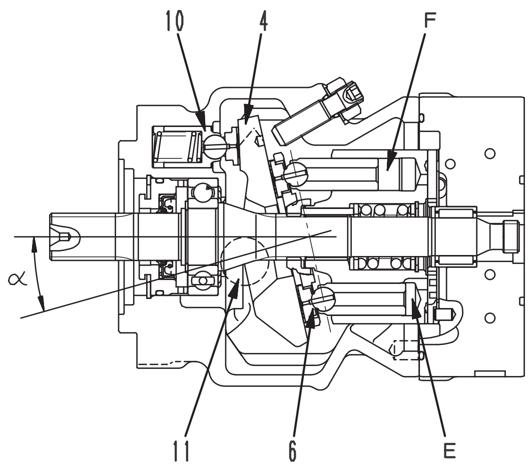
9JY01791

- When the center line **X** of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of **E** and **F** inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of oil. (In actual fact, the swash plate angle never becomes 0.)
- In other words, discharge amount of the pump is directly proportional to the swash plate angle "α".



9JY01792

- As the swash plate angle "α" becomes larger, difference between the capacities **E** and **F** becomes larger, so the discharge amount **Q** increases.
  The swash plate angle "α" is changed by the servo piston (10).
- Servo piston (10) is reciprocated straight by the signal pressure of the PC and LS valves. This reciprocation is transferred to rocker cam (4). Rocker cam (4) supported on ball (11) rocks around ball (11).
- The output pressure **PEN** of the LS valve is applied to the pressure chamber of servo piston (10).
- As output pressure **PEN** rises, rocker cam (4) moves to reduce the swash plate angle "α", so the discharge amount **Q** decreases.



9JY01793

2. Operation as double pump

- The number of the holes of cylinder block (7) is even. The ports on the face in contact with valve plate (8) are connected to every second long oval port on the periphery of valve plate (8).
- The two long oval ports of valve plate (8) are equivalent to the two discharge ports of the pump, and the pump operates as a double pump.
- While the machine is not traveling, the oil flows are merged inside the control valve and the pump operates as a single pump (Merging mode).
- When the machine travels, the two discharge ports of the pump are connected respectively to the right and left travel ports (Separation mode).
- While the machine is traveling straight, the pump is in the separation mode described above. Since the travel pressures on both sides are the same basically, the pump operates as a single pump. (If the work equipment is operated while the machine is traveling, the pump is set in the merging mode.)
- When the machine steers during travel, however, the pump generates two pressures; One pressure rises for the outer track and the other lowers for the inner track. (For example, the higher pressure is applied to the even cylinder block ports and the lower pressure is applied to the odd ports.)
- As explained above, the oil flow is separated and pressure difference is generated only when the machine is steered during travel.
- The PC control is carried out with the average of the above 2 pump pressures.

3. Superiority of double pump system

- Usually, when the machine having a double pump system is steered during travel, the motor pressure on the drive side (outside) rises and that on the driven side (inside) lowers.
- In the case of an ordinary single pump system, the pressure compensation valve in the control valve operates according to the characteristics of the system, then the motor pressure on the driven side becomes the same as that on the drive side.
- In short, the pressure compensation valve on the driven side is closed and the pressure in the circuit on the driven side and that on the drive side are increased by the same degree.
- In the case of the double pump system, on the other hand, the motor pressure on the driven side is kept low, thus lowering of the oil flow rate in the motor on the drive side is restricted. Accordingly, the engine power is used as shown below;

1) When the single pump system is used

When the machine travels straight:

- Right pressure 9.80 MPa {100 kg/cm^2} x Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm^2} x Left flow rate (50.0 ℓ/min) = 8.10 kW {11.0 PS} + 8.10 kW {11.0 PS} = 16.2 kW {22.0 PS}

When the machine is steered:

- Right pressure 19.6 MPa {200 kg/cm^2} x Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm^2} x Left flow rate (40.0 ℓ/min) = 16.2 kW {22.0 PS} + 6.60 kW {9.0 PS} = 22.8 kW {31.0 PS}

Since the pump input horsepower is larger than the engine horsepower, the PC control starts (to prevent the engine from stalling).

- Right pressure 19.6 MPa {200 kg/cm^2} x Right flow rate (30.0 ℓ/min) + Left pressure 19.6 MPa {200 kg/cm2} x Left flow rate (20.0 ℓ/min) = 9.60 kW {13.0 PS} + 6.60 kW {9.0 PS} = 16.2 kW {22.0 PS}

The average flow rate of both sides is reduced from 50.0 ℓ/min to 25.0 ℓ/min (Reduction by 50%).

2) When the double pump system is used

When the machine travels straight:

- Right pressure 9.80 MPa {100 kg/cm^2} x Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm^2} x Left flow rate (50.0 ℓ/min) = 8.10 kW {11.0 PS} + 8.10 kW {11.0 PS} = 16.2 kW {22.0 PS}

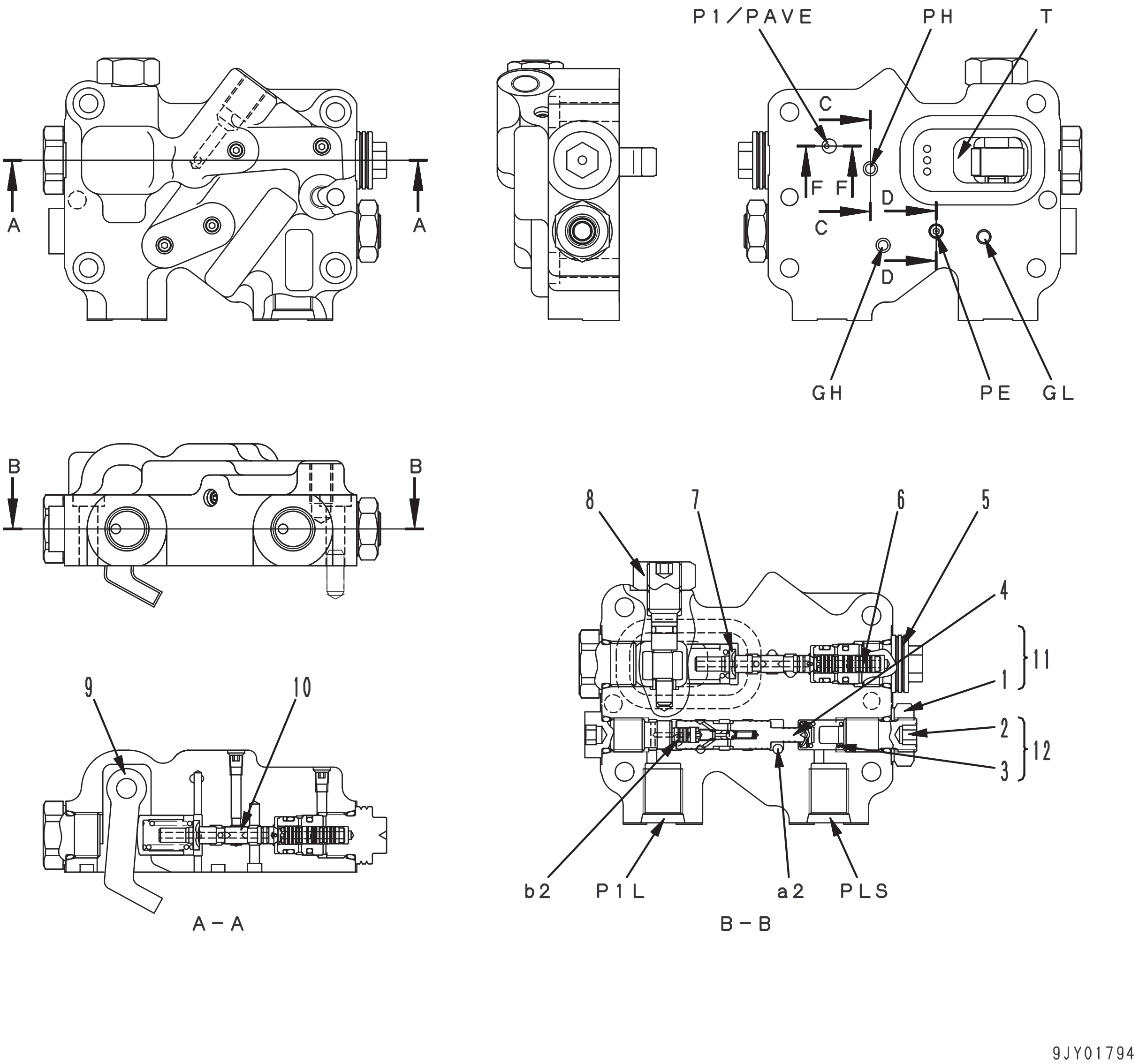
When the machine is steered:

- Right pressure 19.6 MPa {200 kg/cm2} x Right flow rate (50.0 ℓ/min) + Left pressure 4.90 MPa {50 kg/cm^2} x Left flow rate (40.0 ℓ/min) = 16.2 kW {22.0 PS} + 2.90 kW {4.0 PS} = 19.1 kW {26.0 PS}
  Since the pump input horsepower is larger than the engine horsepower, the PC control starts (to prevent the engine from stalling).
- Right pressure 19.6 MPa {200 kg/cm2} x Right flow rate (43.0 ℓ/min) + Left pressure 4.90 MPa {50.0 kg/cm^2} x Left flow rate (33.0 ℓ/min) = 14.0 kW {19.0 PS} + 2.20 kW {3.0 PS} = 16.2 kW {22.0 PS}

The average flow rate of both sides is reduced from 50.0 ℓ/min to 38.0 ℓ/min (Reduction by 24.0%).

When the machine having the ordinary single pump system is steered, the flow rate is reduced by 50%. If the double pump system is used, however, the reduction of the flow rate is only 24%.

VALVE ASSEMBLY



T : Drain
GH : Gear pump HI signal (a2)
GL : Gear pump LO signal (b2)
P1 : Pump signal pressure
PE : Control piston pressure
PH : Pump shuttle pressure (Pump pressure)
P1L : Pump pressure input
PLS : LS pressure input
PAVE : Pump average pressure (Pump pressure)

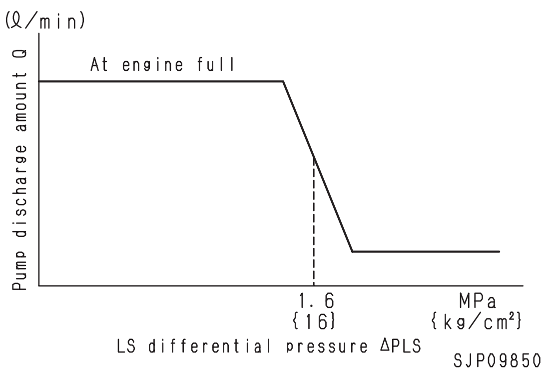
1. Locknut
2. Plug
3. Spring
4. Spool
5. Sleeve
6. Piston
7. Seat
8. Plug
9. Lever
10. Spool
11. PC valve
12. LS valve

FUNCTION

1. LS valve

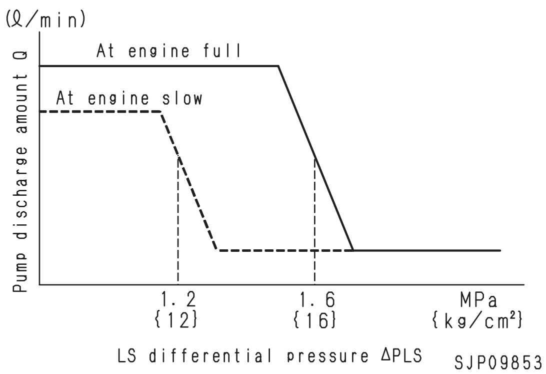
PC35MR-2

- The LS valve controls the discharge of the pump according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve calculates the demand flow for the actuator from differential pressure Δ**PLS** between pump discharge pressure **PP** and control valve outlet pressure **PLS**, and controls pump discharge **Q**.
  (**PP** is called the pump discharge pressure, **PLS** called the LS pressure, and Δ**PLS** called the LS differential pressure.)
- That is, the pump discharge is controlled according to the demand flow for the actuator by the following method; The pressure loss made when the oil flows through the opening of the control valve spool (LS differential pressure Δ**PLS**) is sensed and pump discharge **Q** is so controlled that the pressure loss will be constant.
- The demand flow for the actuator is always supplied, however, as long as it does not exceed the maximum pump discharge in the fine control mode, etc. Accordingly, the pump discharge is kept at the same level, regardless of the engine speed. To prevent this, the LS differential pressure is automatically set low and the pump discharge is reduced when the engine speed is low.



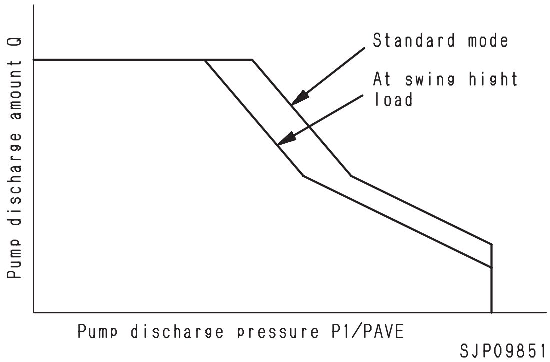
PC40MR, 50MR-2

- The LS valve controls the pump discharge according to the stroke of the control lever, or the flow rate required by the actuator.
- This valve determines the flow rate required by the actuator from differential pressure Δ**PLS** between main pump discharge pressure **P1L** and control valve outlet pressure **PLS**, then controls main pump discharge **Q**.
  (**P1L** is called the pump pressure, **PLS** LS pressure, and Δ**PLS** LS differential pressure.)
- To put it concretely, the LS valve senses the pressure loss (= LS differential pressure Δ**PLS**) caused by the flow of oil from the pump through the opening of the control valve spool, then controls pump discharge **Q** so that this pressure loss will be constant. Consequently, the LS valve supplies the oil according to the demand of the control valve.
- In the range of fine control, etc. where the oil flow rate does not exceed the pump capacity, the pump discharge is kept constant even if the engine speed is low or full, since the LS valve always secures the oil flow rate required by the control valve. To solve this problem, the LS differential pressure is automatically set low to reduce the discharge when the engine speed is low.
- The engine speed is sensed by checking pressures **GH** and **GL** before and after the fixed throttle (metering throttle) of the discharge passage of the swing gear pump, and those pressures are applied to the third and fourth pressure receiving chambers **a2** and **b2** in the LS valve to change the setting of the LS valve.
- When the engine speed is low, the swing pump discharge is reduced and pressures **GH** and **GL** before and after the metering throttle are almost the same (the metering differential pressure calculated by **GH** – **HL** is low). On the other hand, when the engine is running at the full speed, the swing pump discharge is increased and the metering differential pressure becomes high.
- When the metering differential pressure is high (the engine speed is high), the LS pressure is set higher than the normal value. When the metering differential pressure is low (the engine speed is low), the LS pressure is set lower than the normal value.
- The LS valve receives pump pressure **P1L**, LS pressure **PLS**, and pressures **GH** and **GL** before and after the metering throttle of the swing gear pump. The relationship between LS differential pressure Δ**PLS** and pump discharge **Q** is shown at right.



2. PC valve

- When pump discharge pressure **P1**/**PAVE** rises, the stroke of the control valve spool is increased and the opening area is increased and pump discharge **Q** is increased. At this time, the PC valve limits pump discharge **Q** according to discharge pressure **P1**/**PAVE** so that the pump absorption horsepower will not exceed the engine horsepower. In other words, the PC valve performs approximate constant-horsepower control.
- That is, if the load on the actuator is increased and pump discharge pressure **P1**/**PAVE** rises during operation, the PC valve reduces pump discharge **Q**. If the pump discharge pressure lowers, the PC valve increases pump discharge **Q**.
- The relationship between pump discharge pressure **P1**/**PAVE** and pump discharge **Q** is shown below.
- When the machine swings, since the swing pump and main pump are installed tandem, the torque absorbed in the main pump is lowered by the part absorbed in the swing pump.
- When the swing pump operates, the total of the main pump absorption torque and swing pump absorption torque is the total absorption torque (100%)



CONTROL VALVE

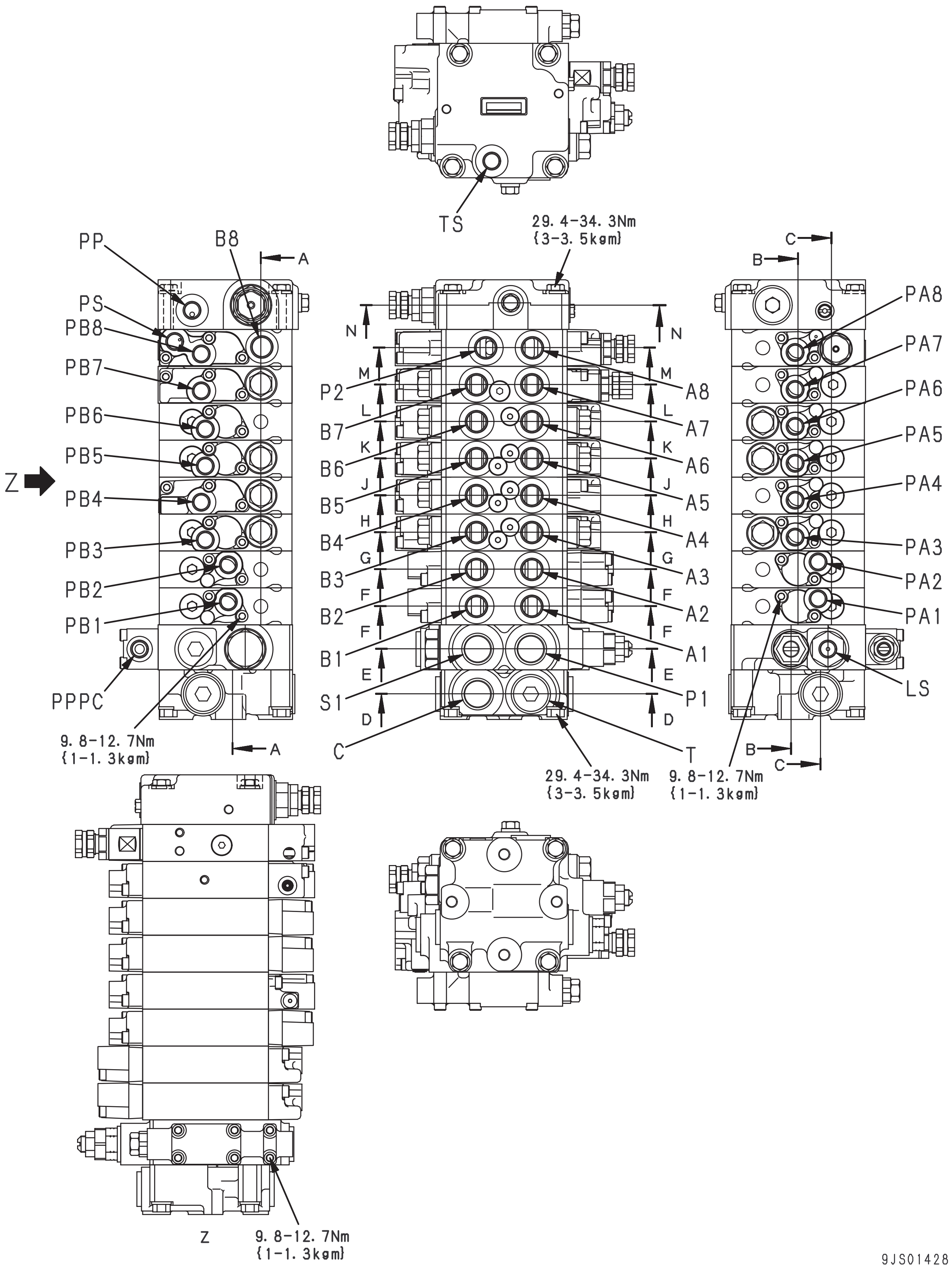
★ The control valve is an add-on type where one service valve each can be added, so it is possible to add valves or remove valves if necessary.
★ The service valve is installed additionally between the top cover and lower valve.
★ As for the 9-spool valve, only the parts different from the 8-spool valve are shown.

PC27MR-2

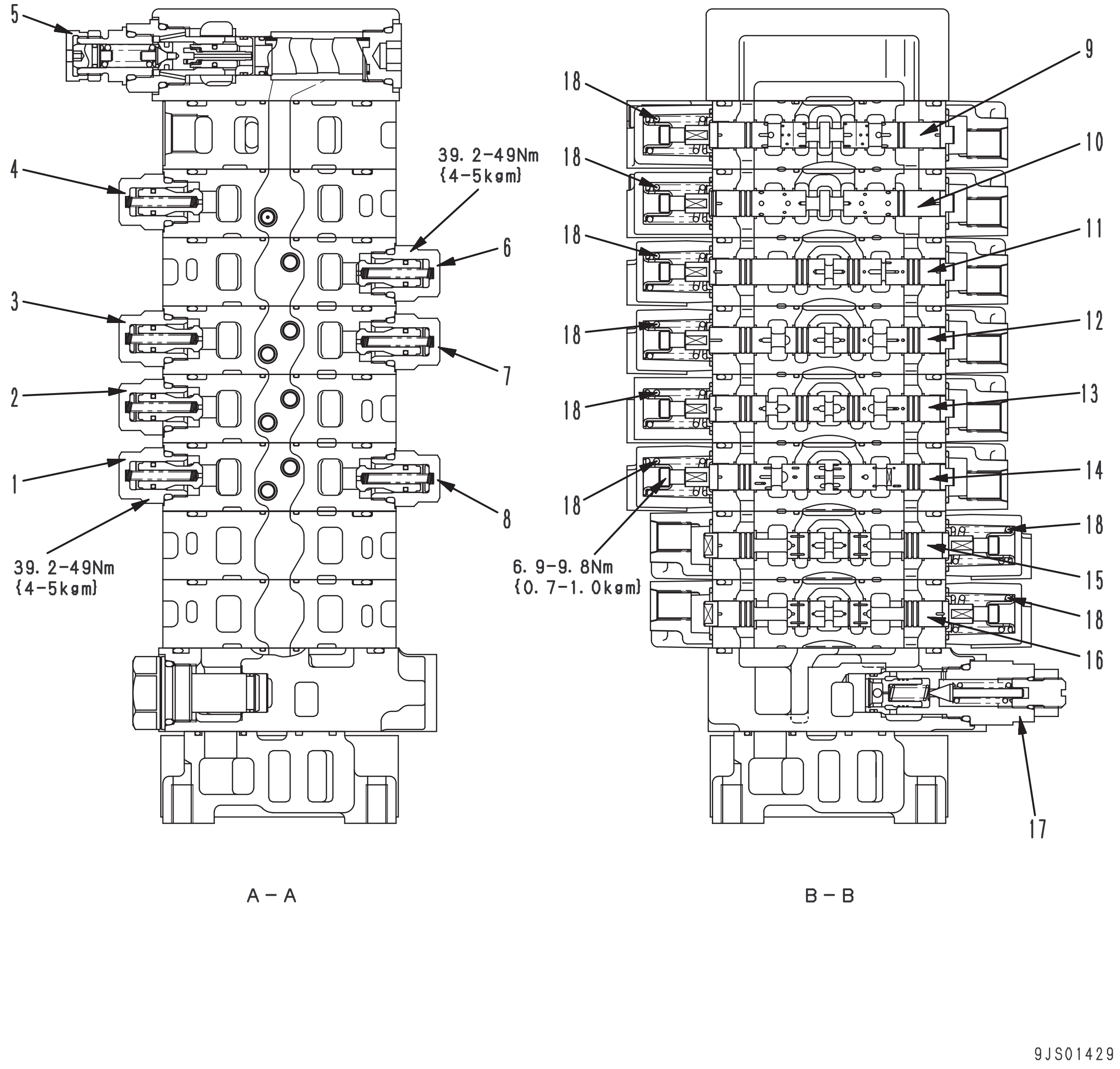
C : To oil cooler
T : To tank
A1 : To R.H. travel motor
A2 : To L.H. travel motor
A3 : To boom cylinder head
A4 : To arm cylinder head
A5 : To bucket cylinder head
A6 : To boom swing cylinder head
A7 : To blade cylinder head
A8 : To swing motor **MA** port
B1 : To R.H. travel motor
B2 : To L.H. travel motor
B3 : To boom cylinder bottom
B4 : To arm cylinder bottom
B5 : To bucket cylinder bottom
B6 : To boom swing cylinder bottom
B7 : To blade cylinder bottom
B8 : To swing motor **MB** port
LS : To pump LS valve
P1 : From main pump to variable pump
P2 : From main pump to gear pump
S1 : To swing motor **S** port
PA1: From R.H. travel FORWARD PPC valve
PA2: From L.H. travel FORWARD PPC valve
PA3: From boom LOWER PPC valve
PA4: From arm OUT PPC valve
PA5: From bucket DUMP PPC valve
PA6: From boom swing R.H. PPC valve
PA7: From blade RAISE PPC valve
PA8: From swing L.H. PPC valve
PB1: From R.H. travel REVERSE PPC valve
PB2: From L.H. travel REVERSE PPC valve
PB3: From boom RAISE PPC valve
PB4: From arm IN PPC valve
PB5: From bucket CURL PPC valve
PB6: From boom swing L.H. PPC valve
PB7: From blade LOWER PPC valve
PB8: From swing R.H. PPC valve
PP : To pump LS valve
PPPC : To solenoid valve **P** port
PS : To swing motor **BR** port
TS : To tank

1. 8 spool valve

(1/5)



(2/5)

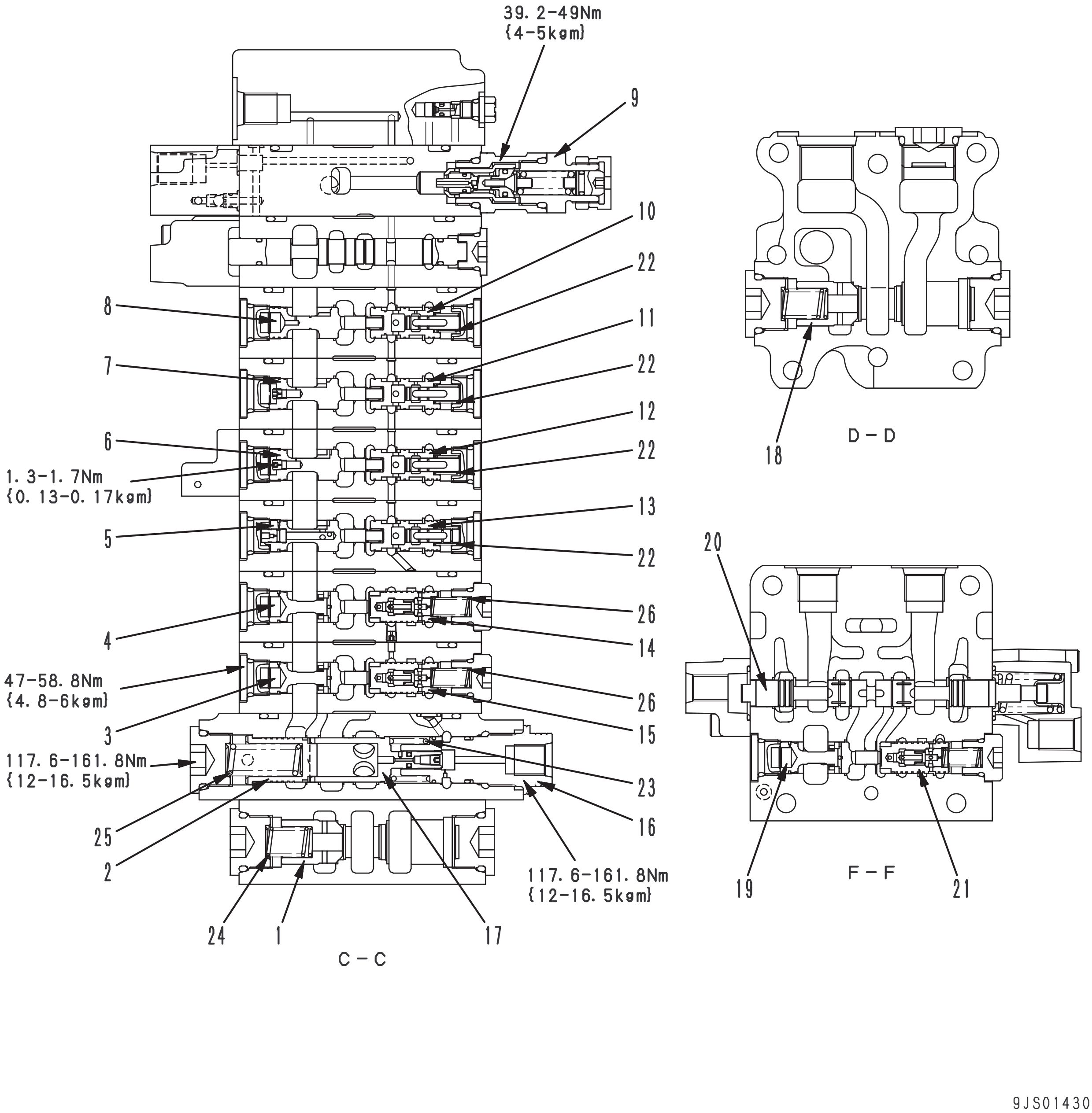

5
4
3
2
1
39. 2-49Nm
{4-5kgm}
6
7
8
39. 2-49Nm
{4-5kgm}
A - A
18
18
18
18
18
18
6. 9-9. 8Nm
{0. 7-1. 0kgm}
9
10
11
12
13
14
18
15
18
16
17
B - B
9JS01429

1. Suction valve (boom bottom)
2. Suction valve (arm bottom)
3. Suction valve (bucket bottom)
4. Suction valve (blade bottom)
5. Safety valve
6. Suction valve (boom swing head)
7. Suction valve (bucket head)
8. Suction valve (boom head)
9. Spool (swing)
10. Spool (blade)
11. Spool (boom swing)
12. Spool (bucket)
13. Spool (arm)
14. Spool (boom)
15. Spool (L.H. travel)
16. Spool (R.H. travel)
17. Main relief valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
18	Spool return spring (Travel, boom, arm, bucket, boom swing, blade, swing)	29.0 x 17.5	28.5	23.6 kN {2.30 kg}	—	18.1 kN {1.80 kg}	Replace spring if damaged or deformed

(3/5)


39.2-49Nm
{4-5kgm}
9
10
22
11
22
12
22
13
22
26
14
26
15
23
16
17
1
24
2
25
3
4
5
6
7
8
1.3-1.7Nm
{0.13-0.17kgm}
47-58.8Nm
{4.8-6kgm}
117.6-161.8Nm
{12-16.5kgm}
117.6-161.8Nm
{12-16.5kgm}
C – C
18
D – D
20
19
21
F – F
9JS01430

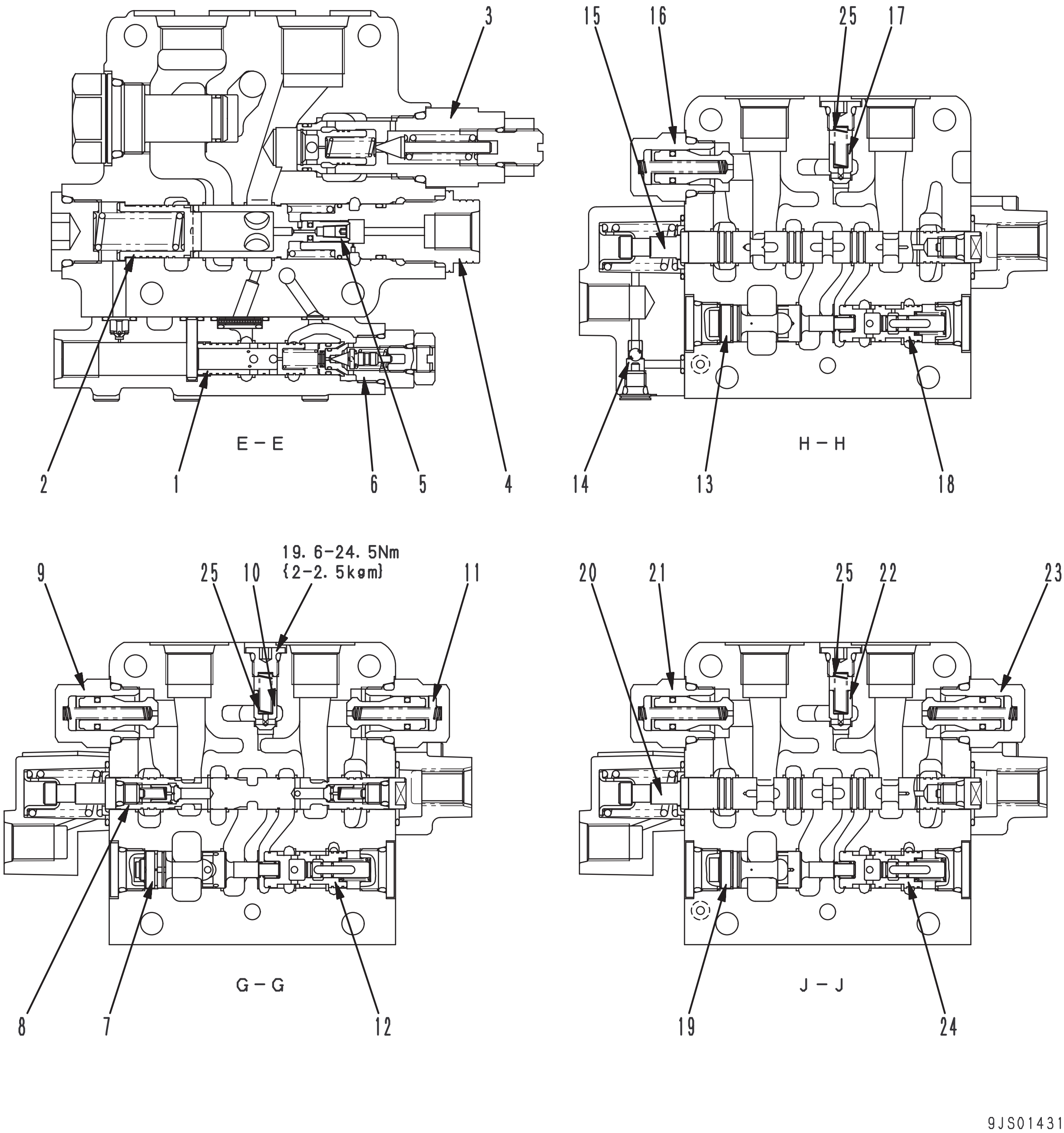
1. Buck pressure check valve
2. Self pressure reducing sequential valve
3. Pressure compensation valve (flow control valve) (R.H. travel)
4. Pressure compensation valve (flow control valve) (L.H. travel)
5. Pressure compensation valve (flow control valve) (boom)
6. Pressure compensation valve (flow control valve) (arm)
7. Pressure compensation valve (flow control valve) (bucket)
8. Pressure compensation valve (flow control valve) (boom swing)
9. Swing relief valve (for gear pump)
10. Pressure compensation valve (boom swing)
11. Pressure compensation valve (pressure reducing valve) (bucket)
12. Pressure compensation valve (pressure reducing valve) (arm)
13. Pressure compensation valve (pressure reducing valve) (boom)
14. Pressure compensation valve (pressure reducing valve) (L.H. travel)
15. Pressure compensation valve (pressure reducing valve) (R.H. travel)
16. LS bypass plug
17. Unload valve
18. Buck pressure check valve
19. Pressure compensation valve (flow control valve)
20. Spool (travel)
21. Pressure compensation valve (pressure reducing valve)

F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
22	Pressure compensation valve spring	20.0 x 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
23	Unload valve spring	28.6 x 19.2	18.0	150 N {15.3 kg}	—	120 N {12.2 kg}	
24	Buck pressure check valve spring	29.0 x 13.3	21.0	15.3 N {1.56 kg}	—	12.2 N {1.25 kg}	
25	Self pressure reducing sequence valve spring	40.5 x 14.3	34.6	104 N {10.6 kg}	—	83.2 N {8.48 kg}	
26	Pressure compensation valve spring	22.5 x 8.40	18.2	9.75 N {0.99 kg}	—	7.8 N {0.80 kg}	

(4/5)


3
15
16
25
17
E – E
H – H
2
1
6
5
4
14
13
18
19. 6–24. 5Nm
{2–2. 5kgm}
9
25
10
11
20
21
25
22
23
G – G
J – J
8
7
12
19
24
9JS01431

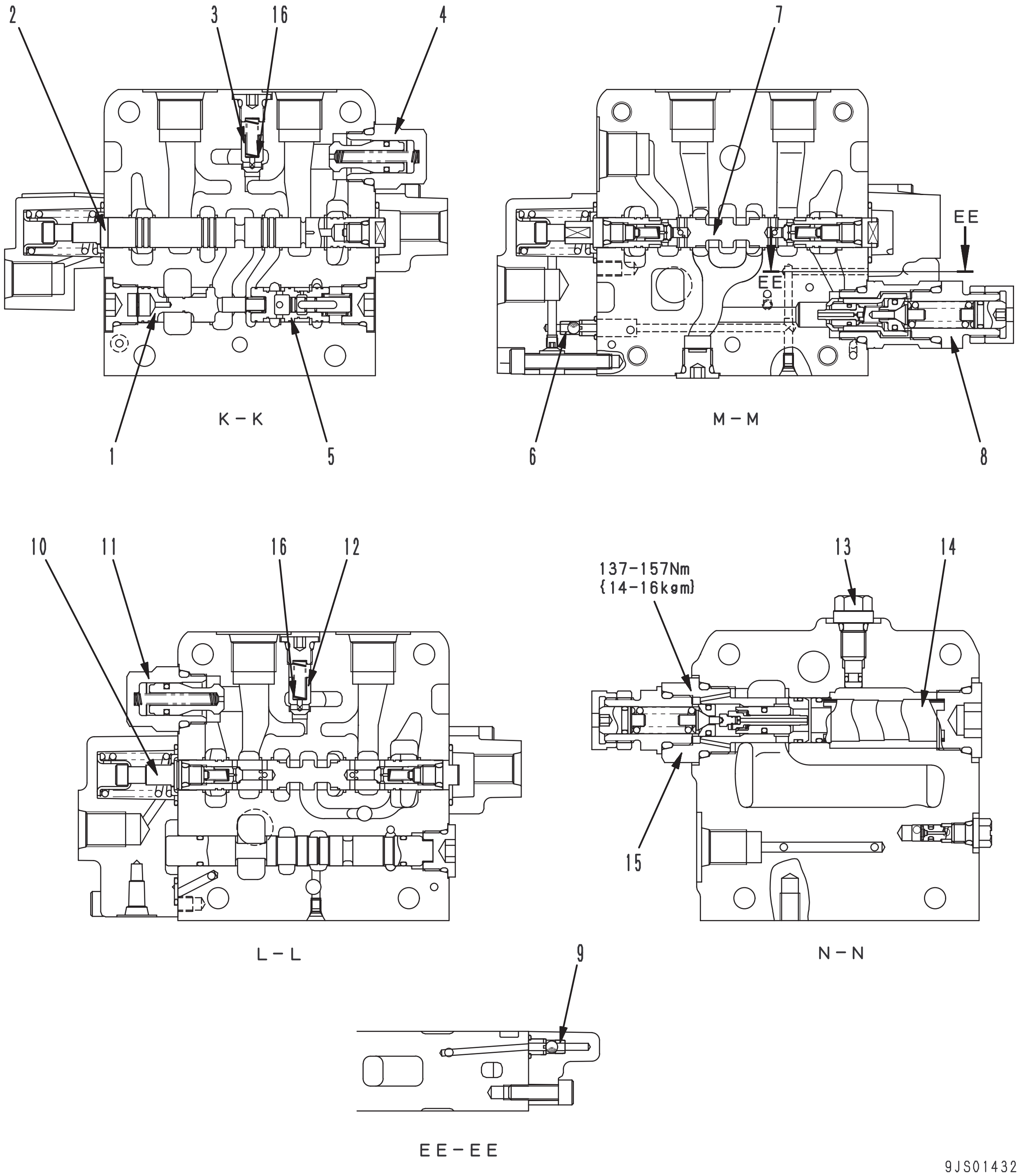
1. Self pressure reducing spool
2. Self reducing sequential valve
3. Main relief valve
4. LS bypass valve
5. Unload valve
6. Self pressure reducing valve
7. Pressure compensation valve (flow control valve)
8. Spool (boom)
9. Suction valve
10. Check valve
11. Suction valve
12. Pressure compensation valve (pressure reducing valve)
13. Pressure compensation valve (flow control valve)
14. Pilot check valve
15. Spool (arm)
16. Suction valve
17. Check valve
18. Pressure compensation valve (pressure reducing valve)
19. Pressure compensation valve (flow control valve)
20. Spool (bucket)
21. Suction valve
22. Check valve
23. Suction valve
24. Pressure compensation valve (pressure reducing valve)

F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
25	Check valve spring (Boom, arm, bucket)	21.9 x 5.0	15.8	1.96 N {0.20 kg}	—	1.57 N {0.16 kg}	Replace spring if damaged or deformed

(5/5)


2
3
16
4
7
EE
EE
1
5
K – K
M – M
6
8
10
11
16
12
13
14
137-157Nm
{14-16kgm}
15
L – L
N – N
9
EE – EE
9JS01432

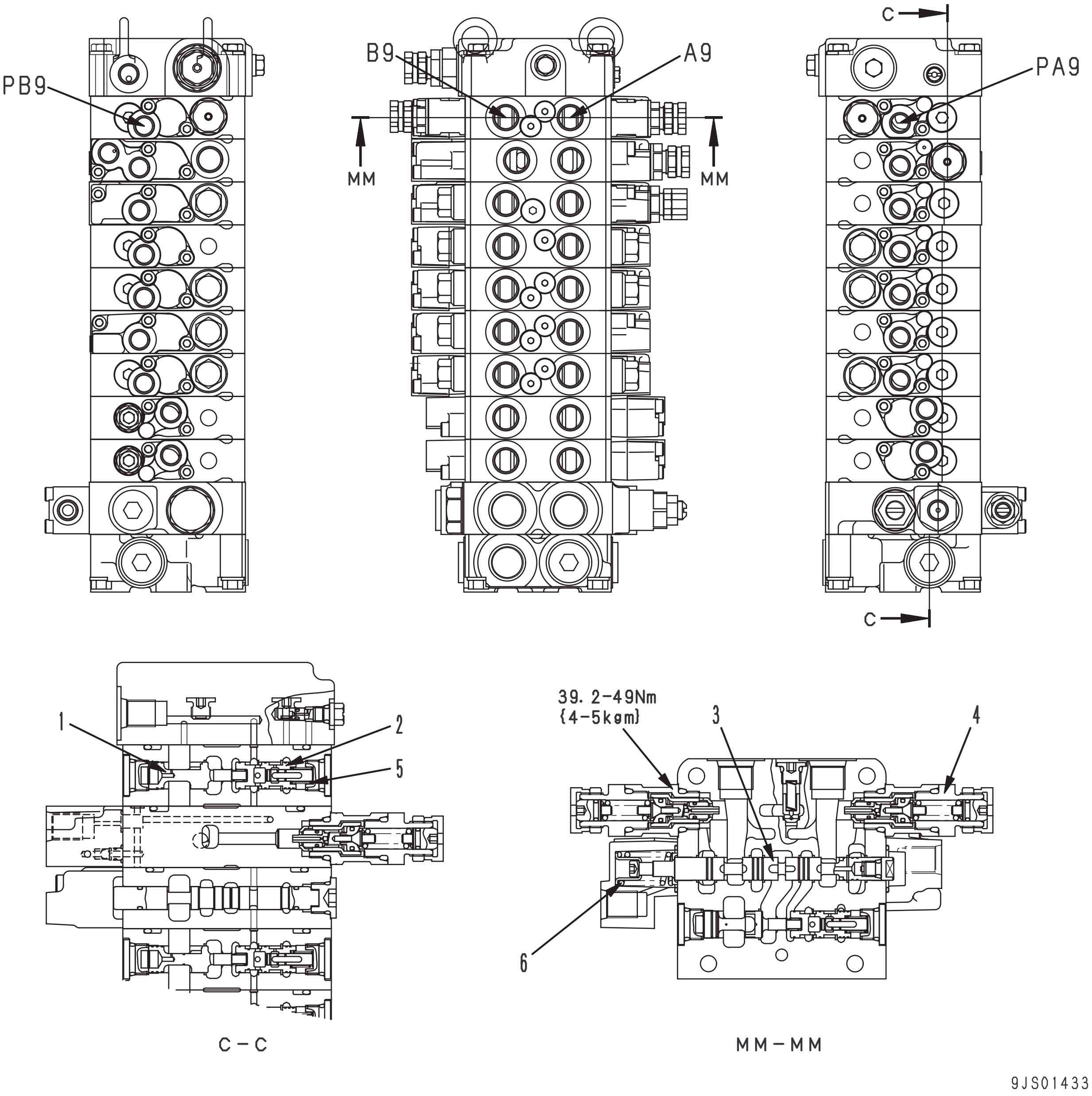
1. Pressure compensation valve (flow control valve)
2. Spool (boom swing)
3. Check valve
4. Suction valve
5. Pressure compensation valve (pressure reducing valve)
6. Pilot pressure check valve
7. Spool (swing)
8. Swing relief valve (for gear pump)
9. Pilot pressure check valve
10. Spool (blade)
11. Suction valve
12. Check valve
13. Air bleeding plug
14. Safty valve circuit filter
15. Safty valve

F : Flow control valve
R : Pressure reducing valve

Unit: mm

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Check item</th><th colspan="5">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><td colspan="3">Standard clearance</td><td colspan="2">Repair limit</td></tr>
<tr><td rowspan="2">16</td><td rowspan="2">Check valve spring
(Boom swing, blade)</td><td>Free length x OD</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td><td rowspan="2">Replace spring if damaged or deformed</td></tr>
<tr><td>21.9 x 5.0</td><td>15.8</td><td>1.96 N
{0.20 kg}</td><td>—</td><td>1.57 N
{0.16 kg}</td></tr>
</table>

2. 9 spool valve



A9: To stop valve
B9: To stop valve
PA9: To attachment PPC valve
PB9: To attachment PPC valve

1. Pressure compensation valve (F attachment)
2. Pressure compensation valve (R attachment)
3. Spool (Attachment)
4. Port relief valve

F: Flow control valve
R: Pressure reducing valve

Unit: mm

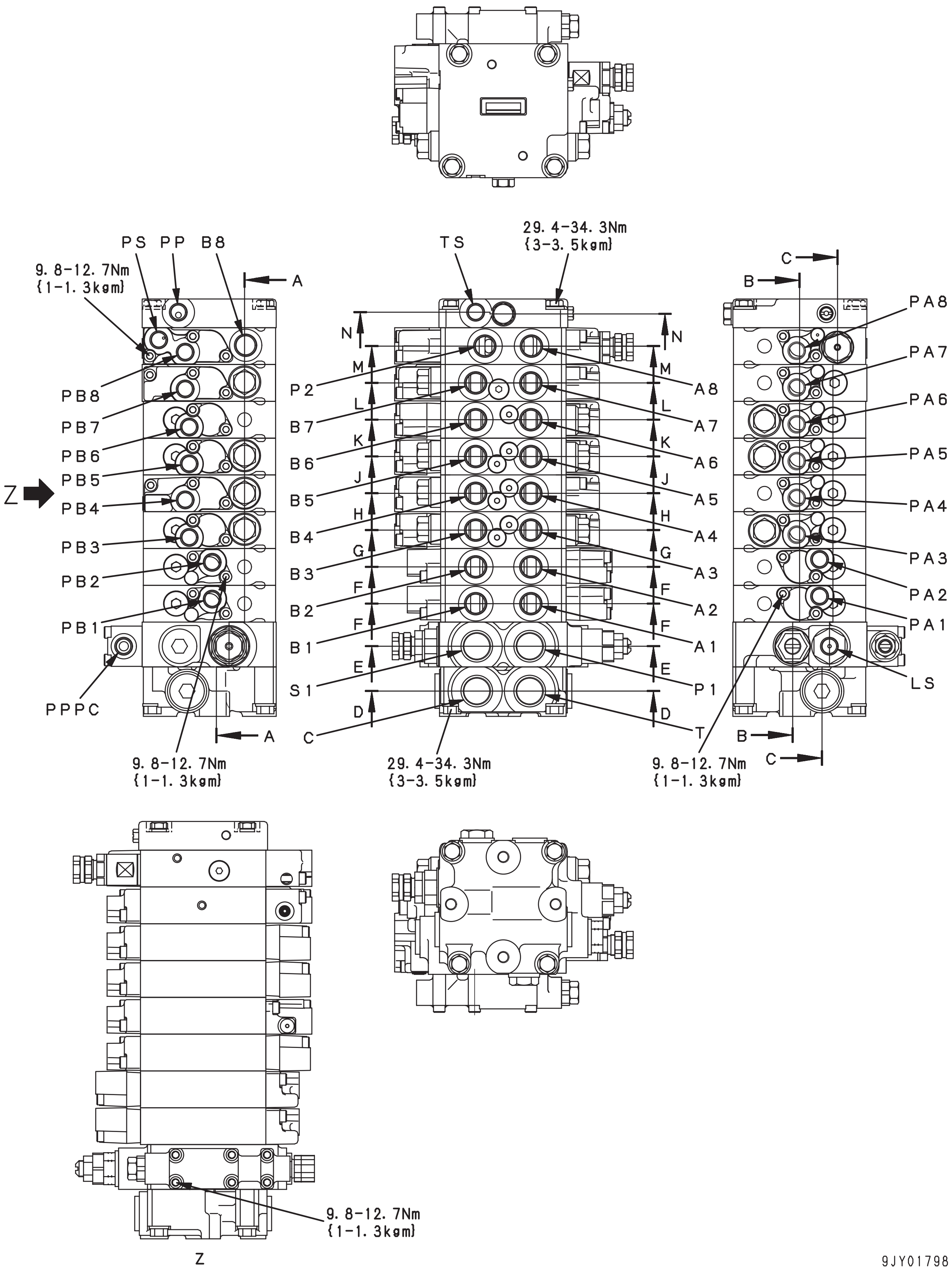
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
5	Pressure compensation valve spring	20.0 x 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
6	Spool return spring (Attachment)	29.0 x 17.5	28.5	22.6 N {2.30 kg}	—	18.1 N {1.80 kg}	

PC30MR-2

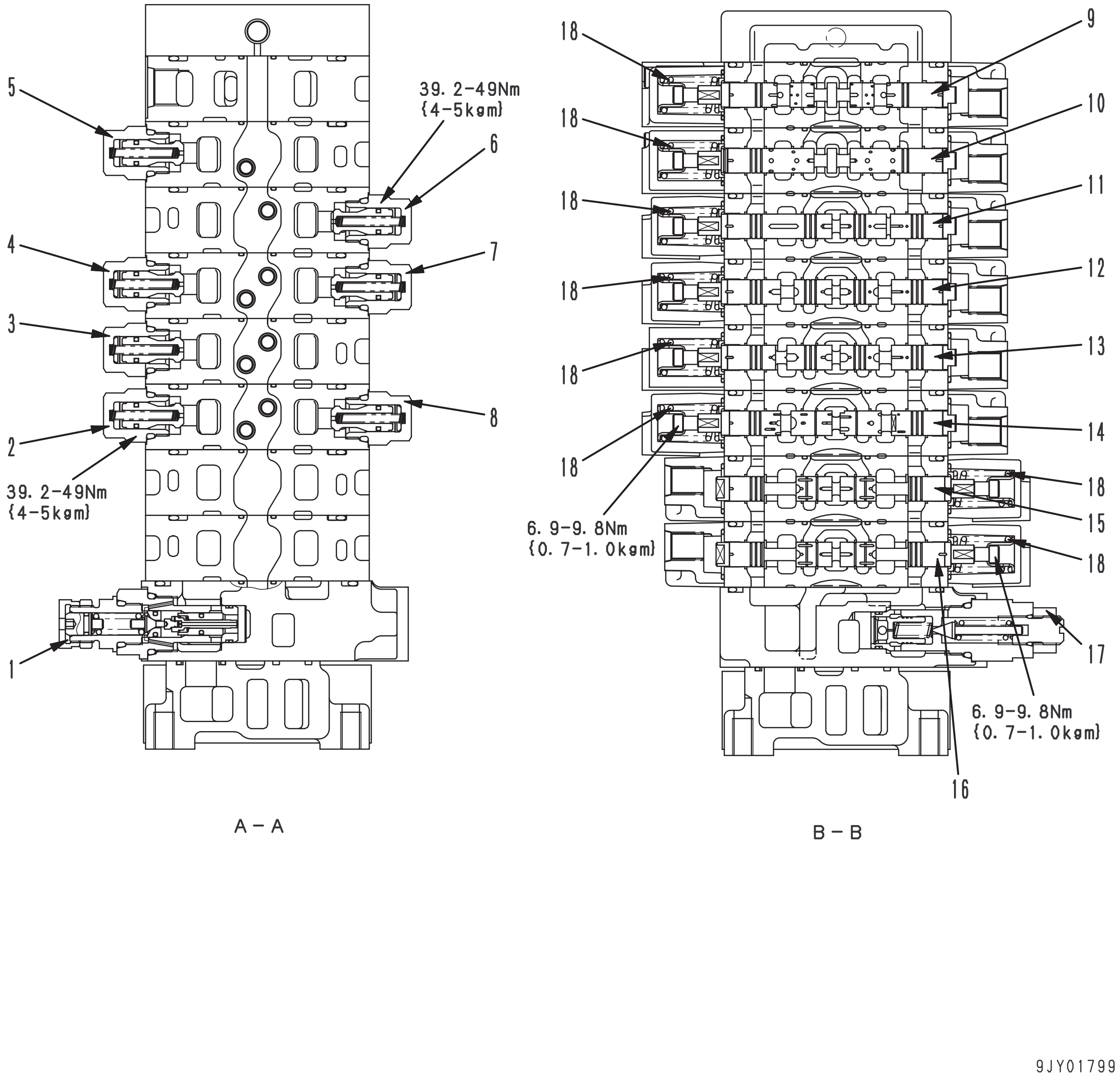
C : To oil cooler
T : To tank
A1 : To R.H. travel motor
A2 : To L.H. travel motor
A3 : To boom cylinder head
A4 : To arm cylinder head
A5 : To bucket cylinder head
A6 : To boom swing cylinder head
A7 : To blade cylinder head
A8 : To swing motor **MA** port
B1 : To R.H. travel motor
B2 : To L.H. travel motor
B3 : To boom cylinder bottom
B4 : To arm cylinder bottom
B5 : To bucket cylinder bottom
B6 : To boom swing cylinder bottom
B7 : To blade cylinder bottom
B8 : To swing motor **MB** port
LS : To pump LS valve
P1 : From main pump to variable pump
P2 : From main pump to gear pump
S1 : To swing motor **S** port
PA1: From R.H. travel FORWARD PPC valve
PA2: From L.H. travel FORWARD PPC valve
PA3: From boom LOWER PPC valve
PA4: From arm OUT PPC valve
PA5: From bucket DUMP PPC valve
PA6: From boom swing R.H. PPC valve
PA7: From blade RAISE PPC valve
PA8: From swing L.H. PPC valve
PB1: From R.H. travel REVERSE PPC valve
PB2: From L.H. travel REVERSE PPC valve
PB3: From boom RAISE PPC valve
PB4: From arm IN PPC valve
PB5: From bucket CURL PPC valve
PB6: From boom swing L.H. PPC valve
PB7: From blade LOWER PPC valve
PB8: From swing R.H. PPC valve
PP : To pump LS valve
PPPC : To solenoid valve **P** port
PS : To swing motor **BR** port
TS : To tank

1. 8 spool valve

(1/5)



(2/5)

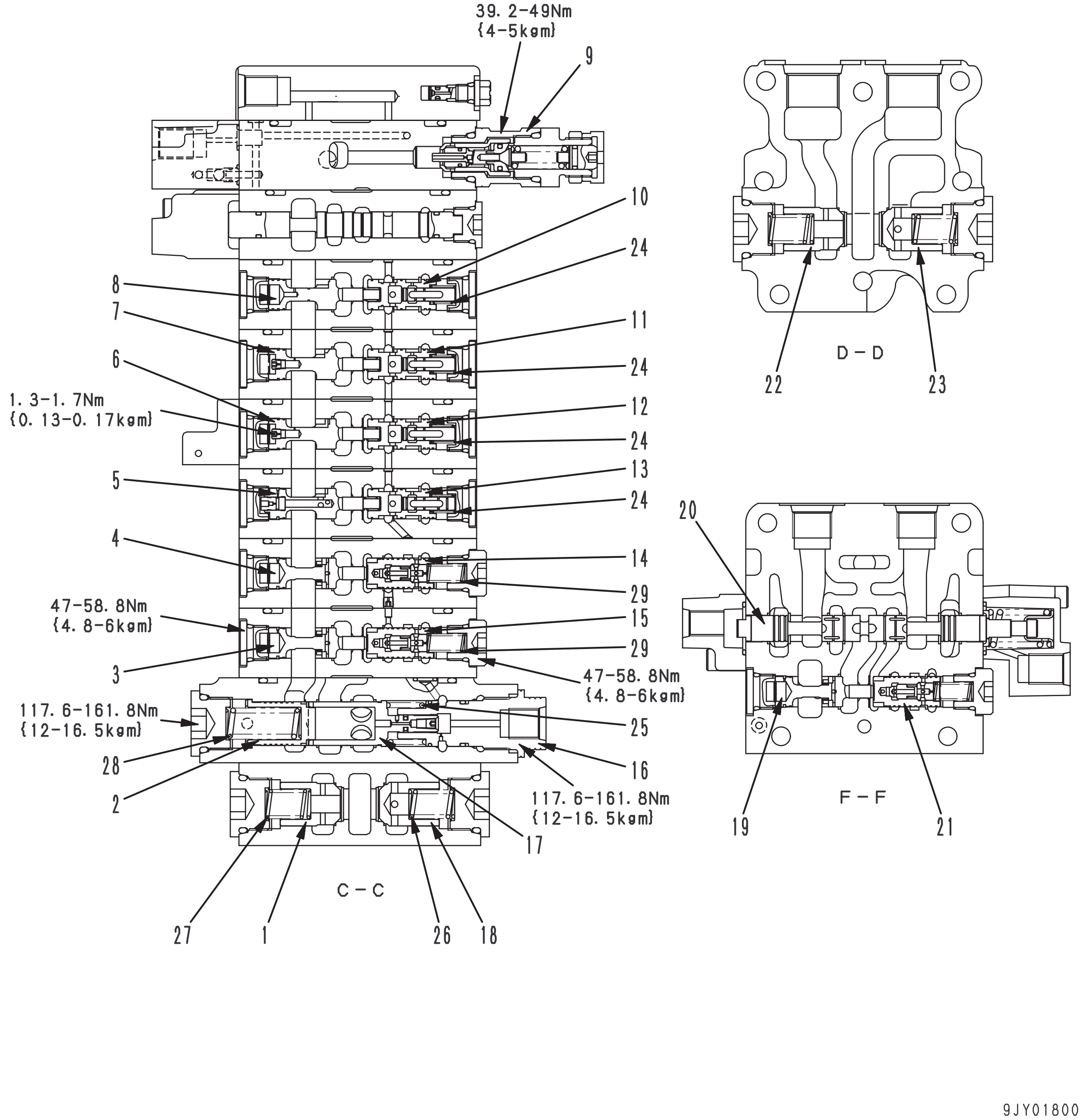

5
39. 2-49Nm
{4-5kgm}
6
4
7
3
2
8
39. 2-49Nm
{4-5kgm}
1
A – A
18
9
18
10
18
11
18
12
18
13
18
14
18
6. 9-9. 8Nm
{0. 7-1. 0kgm}
18
15
18
17
6. 9-9. 8Nm
{0. 7-1. 0kgm}
16
B – B
9JY01799

1. Safety valve
2. Suction valve (boom bottom)
3. Suction valve (arm bottom)
4. Suction valve (bucket bottom)
5. Suction valve (blade bottom)
6. Suction valve (boom swing head)
7. Suction valve (bucket head)
8. Suction valve (boom head)
9. Spool (swing)
10. Spool (blade)
11. Spool (boom swing)
12. Spool (bucket)
13. Spool (arm)
14. Spool (boom)
15. Spool (L.H. travel)
16. Spool (R.H. travel)
17. Main relief valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
18	Spool return spring (Travel, boom, arm, bucket, boom swing, blade, swing)	29.0 x 17.5	28.5	23.6 kN {2.30 kg}	—	18.1 kN {1.80 kg}	Replace spring if damaged or deformed

(3/5)


39.2-49Nm
{4-5kgm}
9
10
24
8
7
11
24
6
1.3-1.7Nm
{0.13-0.17kgm}
12
24
5
13
24
4
14
29
47-58.8Nm
{4.8-6kgm}
15
29
3
47-58.8Nm
{4.8-6kgm}
117.6-161.8Nm
{12-16.5kgm}
25
28
16
2
117.6-161.8Nm
{12-16.5kgm}
17
C – C
27
1
26
18
D – D
22
23
20
F – F
19
21
9JY01800

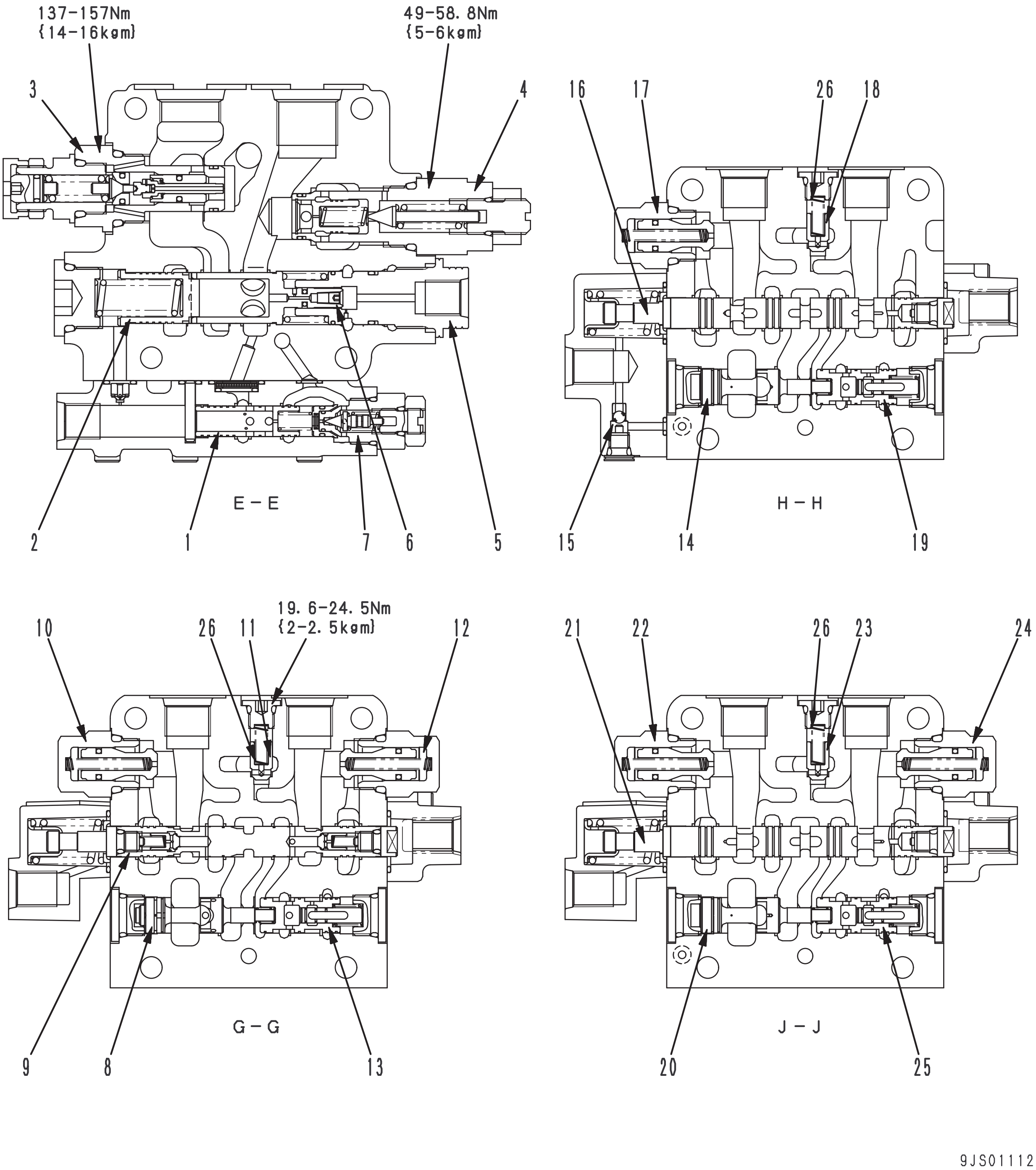
1. Buck pressure check valve
2. Self pressure reducing sequential valve
3. Pressure compensation valve (flow control valve) (R.H. travel)
4. Pressure compensation valve (flow control valve) (L.H. travel)
5. Pressure compensation valve (flow control valve) (boom)
6. Pressure compensation valve (flow control valve) (arm)
7. Pressure compensation valve (flow control valve) (bucket)
8. Pressure compensation valve (flow control valve) (boom swing)
9. Swing relief valve (for gear pump)
10. Pressure compensation valve (boom swing)
11. Pressure compensation valve (pressure reducing valve) (bucket)
12. Pressure compensation valve (pressure reducing valve) (arm)
13. Pressure compensation valve (pressure reducing valve) (boom)
14. Pressure compensation valve (pressure reducing valve) (L.H. travel)
15. Pressure compensation valve (pressure reducing valve) (R.H. travel)
16. LS bypass plug
17. Unload valve
18. Cooler bypass valve
19. Pressure compensation valve (flow control valve)
20. Spool (travel)
21. Pressure compensation valve (pressure reducing valve)
22. Buck pressure check valve
23. Cooler bypass valve

F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
24	Pressure compensation valve spring	20.0 x 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
25	Unload valve spring	28.6 x 19.2	18.0	150 N {15.3 kg}	—	120 N {12.2 kg}	
26	Cooler check valve spring	27.2 x 13.2	21.0	78.8 N {8.04 kg}	—	63.0 N {6.43 kg}	
27	Buck pressure check valve spring	29.0 x 13.3	21.0	15.3 N {1.56 kg}	—	12.2 N {1.25 kg}	
28	Self pressure reducing sequence valve spring	40.5 x 14.3	34.6	104 N {10.6 kg}	—	83.2 N {8.48 kg}	
29	Pressure compensation valve spring	22.5 x 8.40	18.2	9.75 N {0.99 kg}	—	7.8 N {0.80 kg}	

(4/5)


137-157Nm
{14-16kgm}
49-58.8Nm
{5-6kgm}
3
4
16
17
26
18
E – E
H – H
2
1
7
6
5
15
14
19
19.6-24.5Nm
{2-2.5kgm}
10
26
11
12
21
22
26
23
24
G – G
J – J
9
8
13
20
25
9JS01112

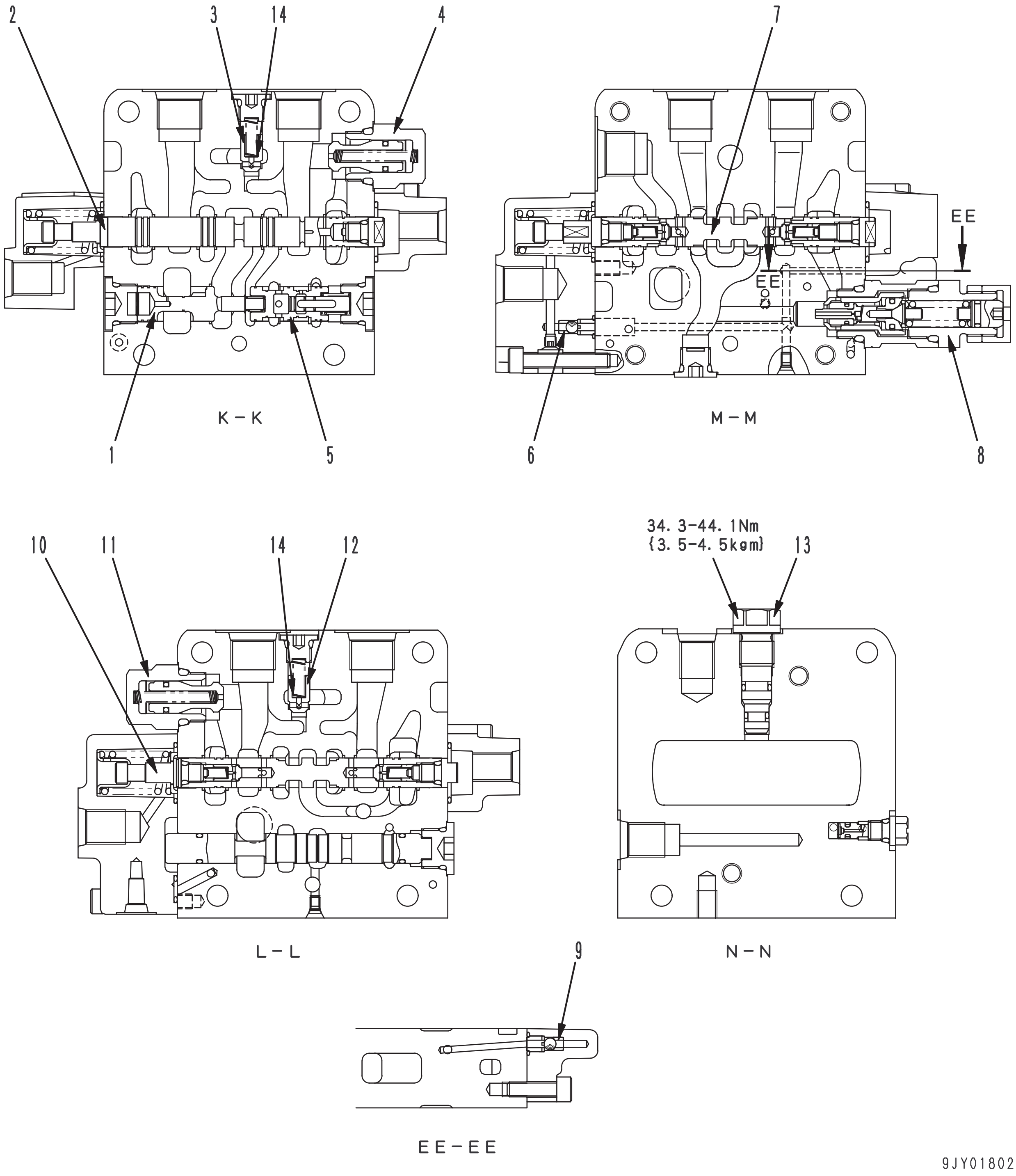
1. Self pressure reducing spool
2. Self reducing sequential valve
3. Safety valve
4. Main relief valve
5. LS bypass valve
6. Unload valve
7. Self pressure reducing valve
8. Pressure compensation valve (flow control valve)
9. Spool (boom)
10. Suction valve
11. Check valve
12. Suction valve
13. Pressure compensation valve (pressure reducing valve)
14. Pressure compensation valve (flow control valve)
15. Pilot check valve
16. Spool (arm)
17. Suction valve
18. Check valve
19. Pressure compensation valve (pressure reducing valve)
20. Pressure compensation valve (flow control valve)
21. Spool (bucket)
22. Suction valve
23. Check valve
24. Suction valve
25. Pressure compensation valve (pressure reducing valve)

F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
26	Check valve spring (Boom, arm, bucket)	21.9 x 5.0	15.8	1.96 N {0.20 kg}	—	1.57 N {0.16 kg}	Replace spring if damaged or deformed

(5/5)


2
3
14
4
7
EE
EE
K – K
M – M
1
5
6
8
10
11
14
12
34. 3–44. 1Nm
{3. 5–4. 5kgm}
13
L – L
N – N
9
EE – EE
9JY01802

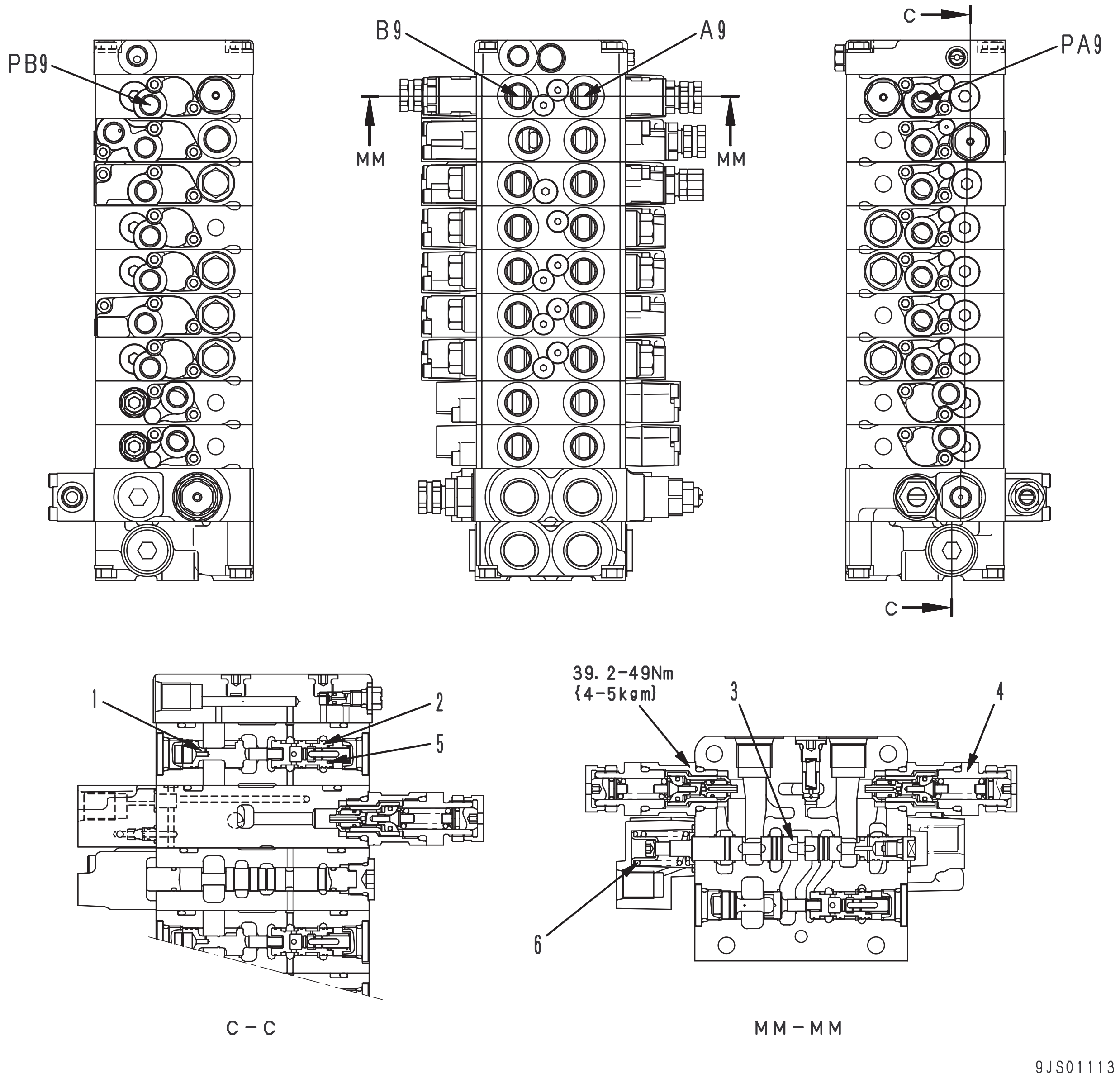
1. Pressure compensation valve (flow control valve)
2. Spool (boom swing)
3. Check valve
4. Suction valve
5. Pressure compensation valve (pressure reducing valve)
6. Pilot pressure check valve
7. Spool (swing)
8. Swing relief valve (for gear pump)
9. Pilot pressure check valve
10. Spool (blade)
11. Suction valve
12. Check valve
13. Air bleeding plug

F : Flow control valve
R : Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
14	Check valve spring (Boom swing, blade)	21.9 x 5.0	15.8	1.96 N {0.20 kg}	—	1.57 N {0.16 kg}	Replace spring if damaged or deformed

2. 9 spool valve



A9: To stop valve
B9: To stop valve
PA9: To attachment PPC valve
PB9: To attachment PPC valve

1. Pressure compensation valve (F attachment)
2. Pressure compensation valve (R attachment)
3. Spool (Attachment)
4. Port relief valve

F: Flow control valve
R: Pressure reducing valve

Unit: mm

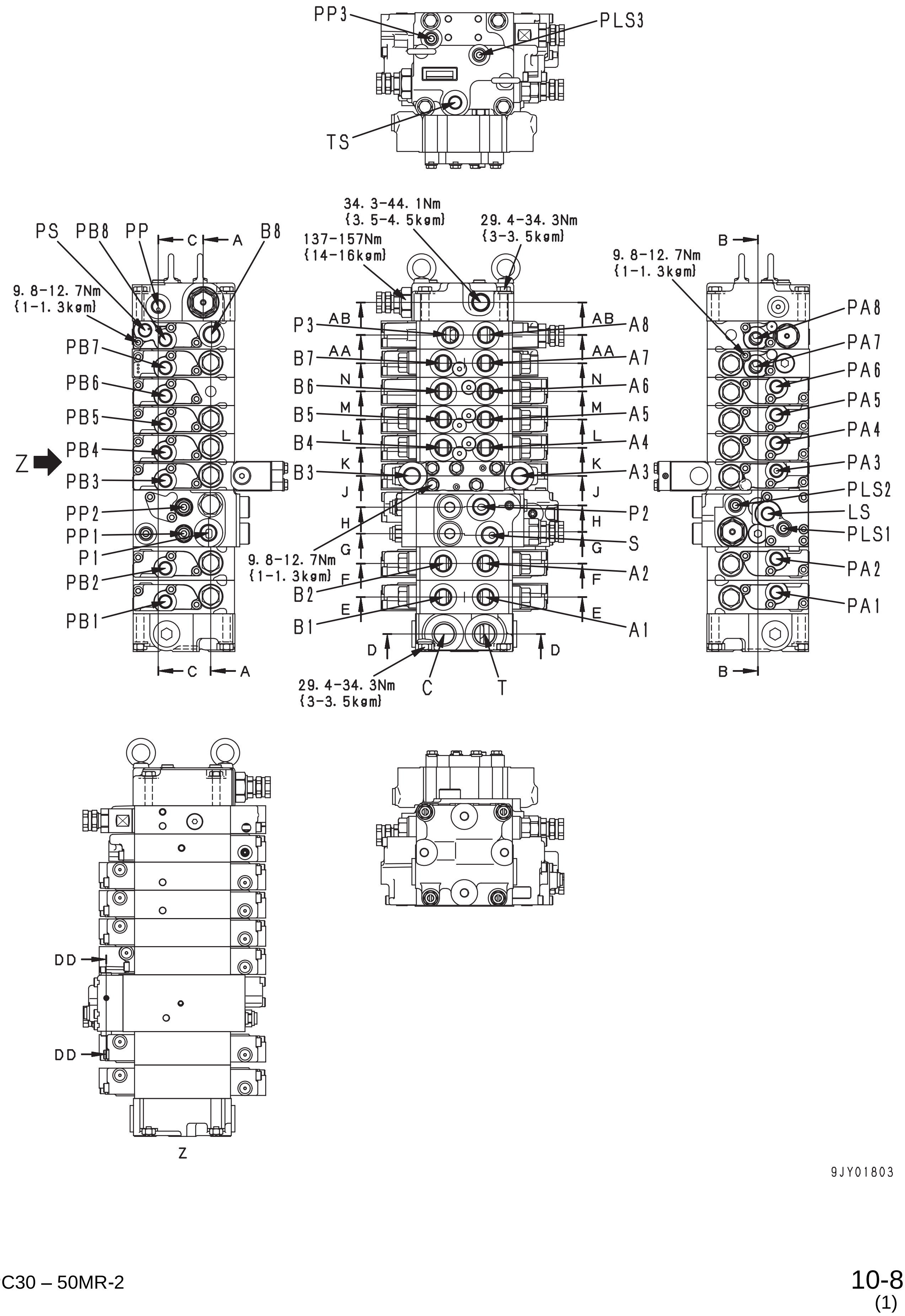
<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Pressure compensation valve spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="4">Replace spring if damaged or deformed</td></tr>
<tr><td>Free length x OD</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>20.0 x 8.40</td><td>12.0</td><td>6.86 N {0.70 kg}</td><td>—</td><td>5.49 N {0.56 kg}</td></tr>
<tr><td>6</td><td>Spool return spring</td><td>29.0 x 17.5</td><td>28.5</td><td>22.6 N {2.30 kg}</td><td>—</td><td>18.1 N {1.80 kg}</td></tr>
</table>

PC35MR, 40MR, 50MR-2

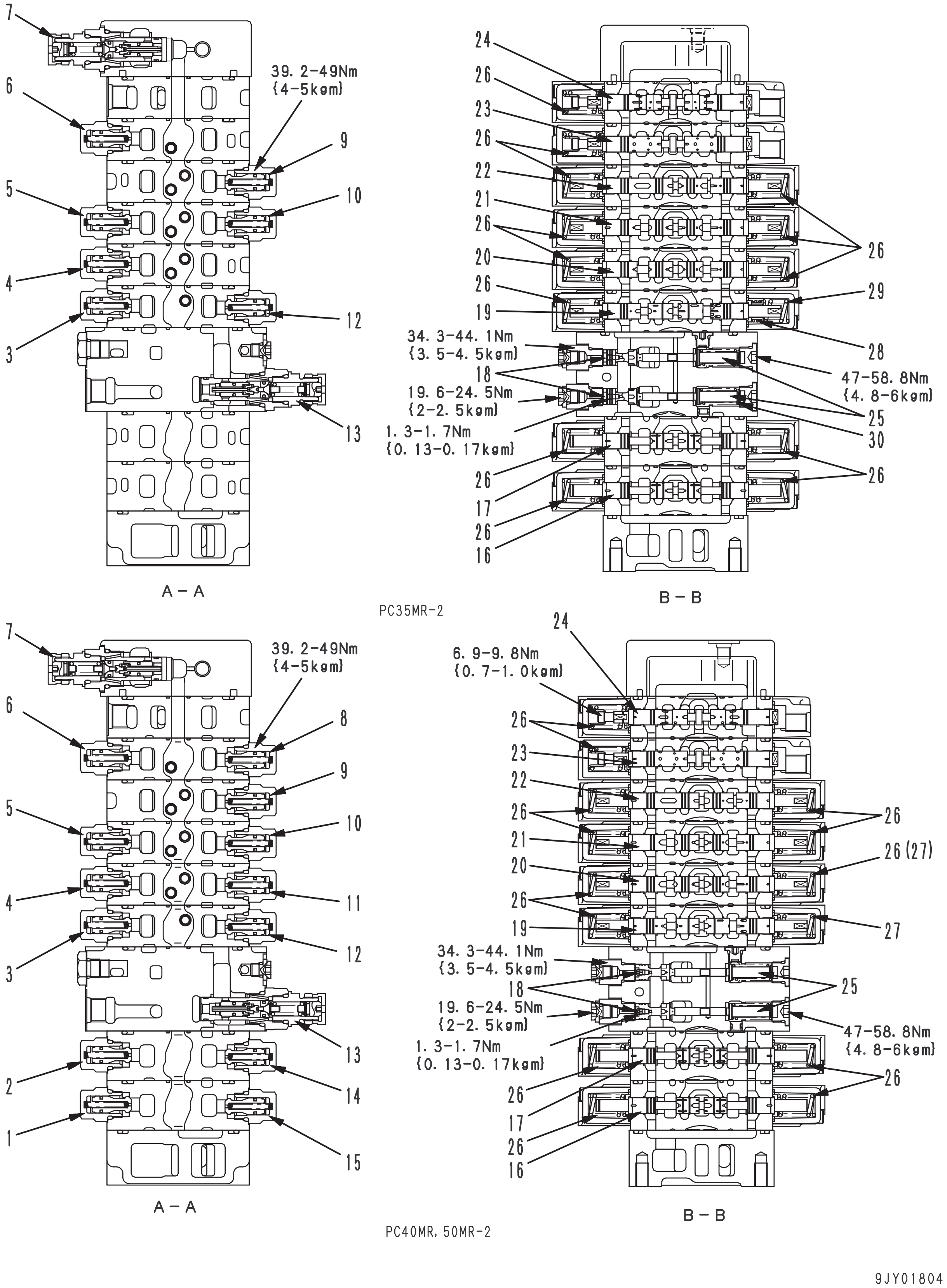
C : To oil cooler
S : To swing motor **S** port
T : To tank
A1 : To L.H. travel motor
A2 : To R.H. travel motor
A3 : To boom cylinder head
A4 : To arm cylinder head
A5 : To bucket cylinder head
A6 : To boom swing cylinder head
A7 : To blade cylinder head
A8 : To swing motor **MB** port
B1 : To L.H. travel motor
B2 : To R.H. travel motor
B3 : To boom cylinder bottom
B4 : To arm cylinder bottom
B5 : To bucket cylinder bottom
B6 : To boom swing cylinder bottom
B7 : To blade cylinder bottom
B8 : To swing motor **MA** port
LS : To pump LS valve
P1 : From main pump to variable pump
P2 : From main pump to variable pump
P3 : From main pump to gear pump
PA1 : From left travel FORWARD PPC valve
PA2 : From right travel FORWARD PPC valve
PA3 : From boom LOWER PPC valve
PA4 : From arm OUT PPC valve
PA5 : From bucket DUMP PPC valve
PA6 : From boom swing R.H. PPC valve
PA7 : From blade RAISE PPC valve
PA8 : From swing L.H. PPC valve
PB1 : From left travel REVERSE PPC valve
PB2 : From right travel REVERSE PPC valve
PB3 : From boom RAISE PPC valve
PB4 : From arm IN PPC valve
PB5 : From bucket CURL PPC valve
PB6 : From boom swing L.H. PPC valve
PB7 : From blade LOWER PPC valve
PB8 : From swing R.H. PPC valve
PLS1 : Left travel LS pressure
PLS2 : Right travel LS pressure
PLS3 : Work equipment LS pressure
PP : To pump LS valve
PP1 : P1 pump pressure
PP2 : P2 pump pressure
PP3 : Pump pressure on work equipment side
PS : To swing motor **B** port
TS : To tank

1. 8 spool valve

(1/6)



(2/6)



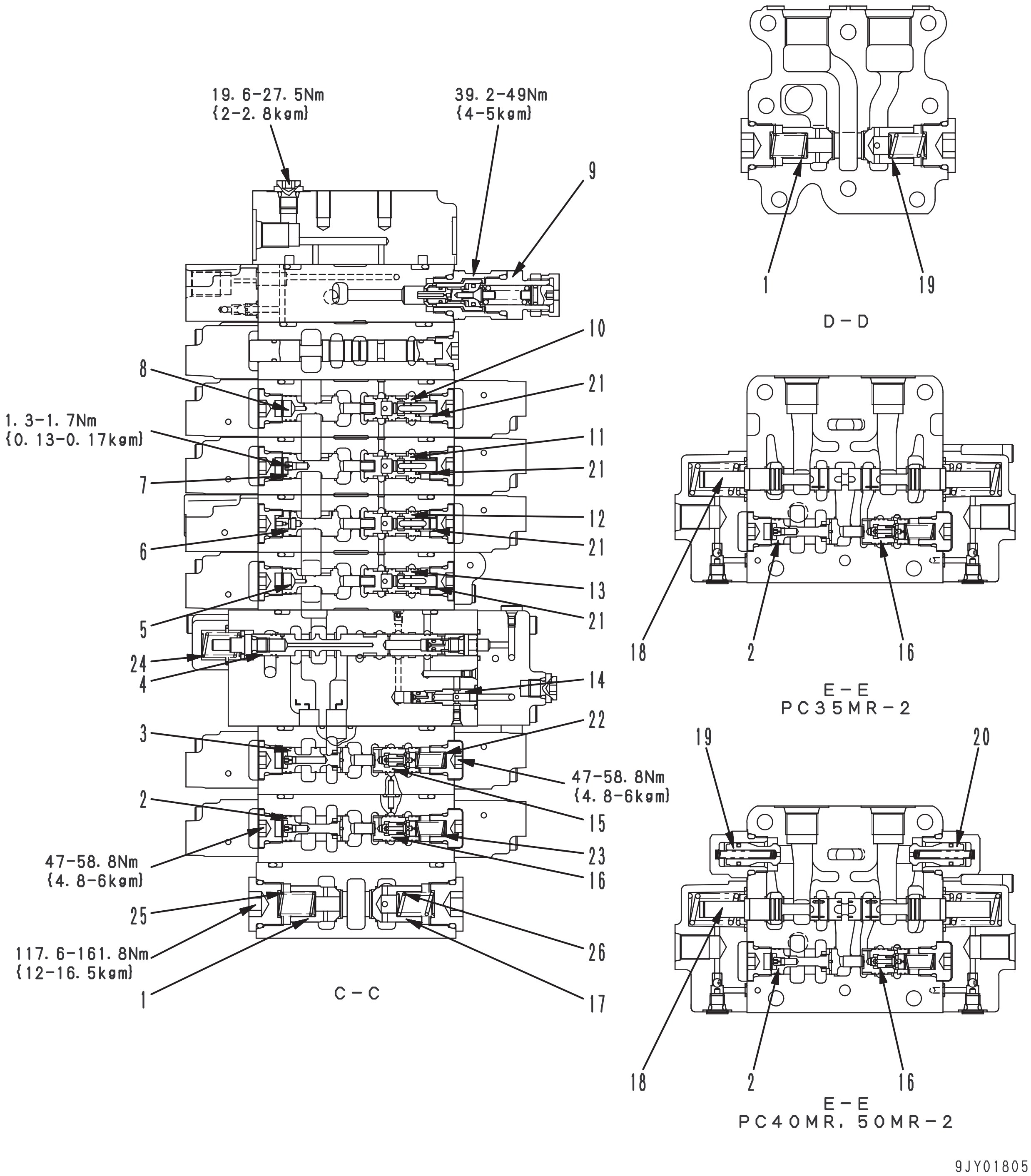
★ The (27) shows PC50MR-2.

1. Suction valve (travel)
2. Suction valve (travel)
3. Suction valve (boom bottom)
4. Suction valve (arm bottom)
5. Suction valve (bucket bottom)
6. Suction valve (blade bottom)
7. Safety valve
8. Suction valve (blade head)
9. Suction valve (boom swing head)
10. Suction valve (bucket head)
11. Suction valve (arm head)
12. Suction valve (boom head)
13. Main relief valve
14. Suction valve (travel)
15. Suction valve (travel)
16. Spool (L.H. travel)
17. Spool (R.H. travel)
18. Unload valve
19. Spool (boom)
20. Spool (arm)
21. Spool (bucket)
22. Spool (boom swing)
23. Spool (blade)
24. Spool (swing)
25. Unload valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
26	Spool return spring (Travel, boom lower, arm, bucket, boom swing, swing, blade)	29.0 x 17.5	28.5	22.6 N {2.30 kg}	—	18.1 N {1.80 kg}	Replace spring if damaged or deformed
27	Spool return spring (Boom RAISE)	29.0 x 17.5	28.5	21.6 N {2.2 kg}	—	17.28 N {1.76 kg}	
28	Spool return spring (Boom RAISE)	13.1 x 16.7	8.5	55.4 N {5.7 kg}	—	44.3 N {4.6 kg}	
29	Spool return spring (Boom RAISE)	20.3 x 17.6	19	55.4 N {5.7 kg}	—	44.3 N {4.6 kg}	
30	Unload valve spring	37.2 x 12.5	33	55.4 N {5.7 kg}	—	44.3 N {4.6 kg}	

(3/6)


19.6-27.5Nm
{2-2.8kgm}
39.2-49Nm
{4-5kgm}
1.3-1.7Nm
{0.13-0.17kgm}
47-58.8Nm
{4.8-6kgm}
47-58.8Nm
{4.8-6kgm}
117.6-161.8Nm
{12-16.5kgm}
C-C
D-D
E-E
PC35MR-2
E-E
PC40MR, 50MR-2
9JY01805

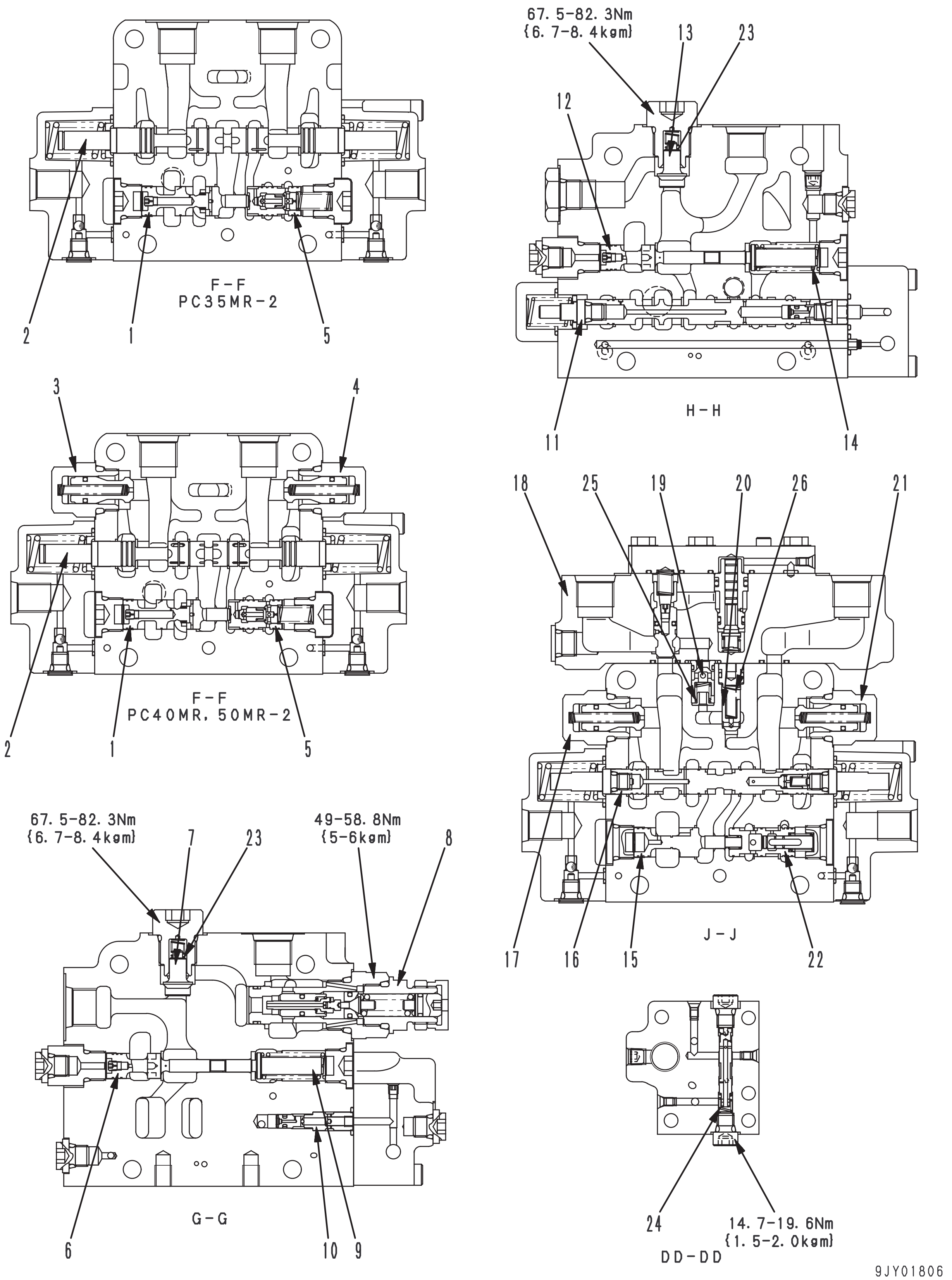
1. Lift check valve
2. Pressure compensation valve (F/Left travel)
3. Pressure compensation valve (F/Right travel)
4. Spool (Pump merge-divider valve)
5. Pressure compensation valve (F/Boom)
6. Pressure compensation valve (F/Arm)
7. Pressure compensation valve (F/Bucket)
8. Pressure compensation valve (F/Boom swing)
9. Swing relief valve (For gear pump)
10. Pressure compensation valve (R/Boom swing)
11. Pressure compensation valve (R/Bucket)
12. Pressure compensation valve (R/Arm)
13. Pressure compensation valve (R/Boom)
14. LS bypass plug (LS2)
15. Pressure compensation valve (R/Right travel)
16. Pressure compensation valve (R/Left travel)
17. Cooler bypass valve
18. Spool (Left travel)
19. Suction valve
20. Suction valve

F : Flow control valve
R : Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
21	Pressure compensation valve spring	20.0 x 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.59 kg}	Replace spring if damaged or deformed
22	Pressure compensation valve spring	22.1 x 8.4	17.0	10.4 N {1.06 kg}	—	8.3 N {0.85 kg}	
23	Pressure compensation valve spring	22.6 x 8.4	17.0	8.34 N {0.85 kg}	—	6.7 N {0.68 kg}	
24	Junction valve spring	41.1 x 13.8	22.0	44.3 N {4.52 kg}	—	35.5 N {3.62 kg}	
25	Buck pressure check valve spring	29.0 x 13.3	21.0	15.3 N {1.56 kg}	—	12.3 N {1.25 kg}	
26	Oil cooler check valve spring	27.2 x 13.2	21.0	78.9 N {8.04 kg}	—	63.0 N {6.43 kg}	

(4/6)


2
1
5
F-F
PC35MR-2
67.5-82.3Nm
{6.7-8.4kgm}
13
23
12
11
14
H-H
3
4
2
1
5
F-F
PC40MR, 50MR-2
18
25
19
20
26
21
17
16
15
22
J-J
67.5-82.3Nm
{6.7-8.4kgm}
7
23
49-58.8Nm
{5-6kgm}
8
6
10
9
G-G
24
14.7-19.6Nm
{1.5-2.0kgm}
DD-DD
9JY01806

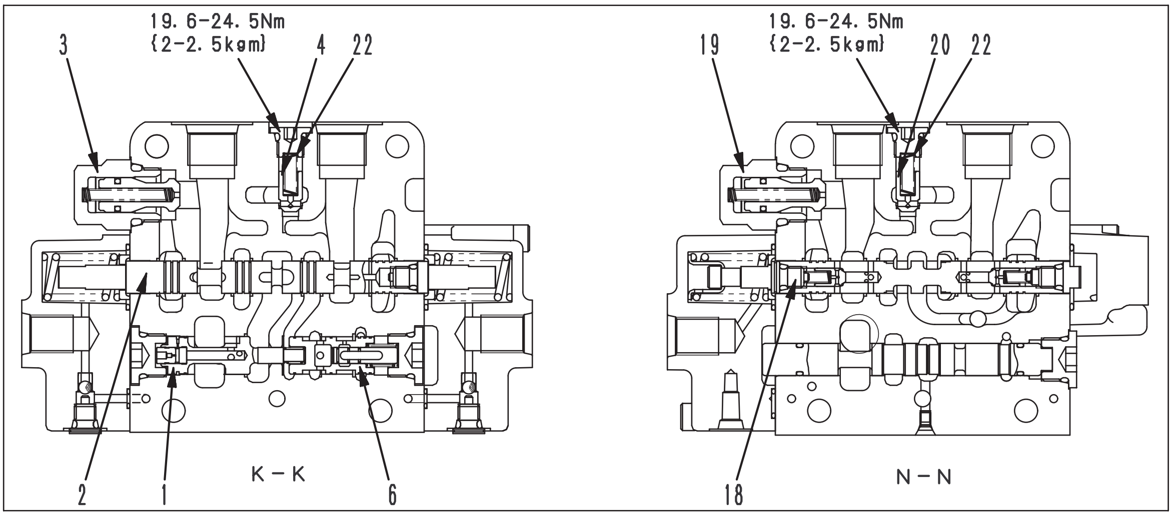
1. Pressure compensation valve (F/Right travel)
2. Spool (Right travel)
3. Suction valve
4. Suction valve
5. Pressure compensation valve (R/Right travel)
6. Unload valve
7. Check valve
8. Main relief valve
9. Unload valve
10. LS bypass plug (LS2)
11. Spool (Pump merge-divider valve)
12. Unload valve
13. Check valve
14. Unload valve
15. Pressure compensation valve (F/Boom)
16. Spool (Boom)
17. Suction valve
18. Boom hydraulic drift prevention valve
19. Check valve
20. Check valve
21. Suction valve
22. Pressure compensation valve (R/Boom)

F : Flow control valve
R : Pressure reducing valve

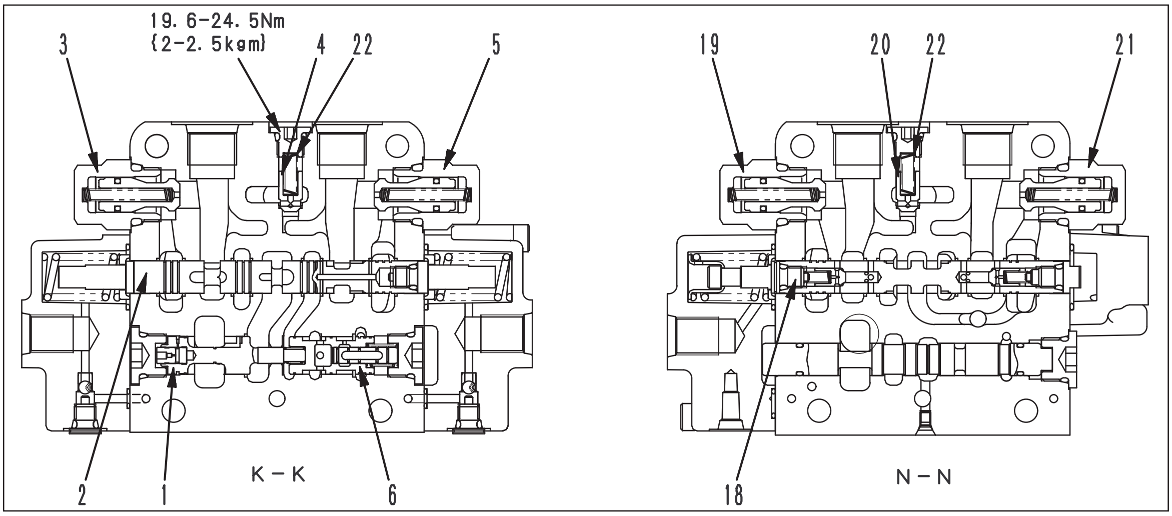
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
23	Check valve spring	13.0 x 6.50	9.0	2.26 N {0.23 kg}	—	1.77 N {0.18 kg}	Replace spring if damaged or deformed
24	Logic valve spring	10.98 x 6.2	9.5	5.5 N {0.56 kg}	—	4.4 N {0.45 kg}	
25	Check valve spring (Boom)	16.4 x 7.5	9.9	2.26 N {0.23 kg}	—	1.77 N {0.18 kg}	
26	Check valve spring (Boom)	21.9 x 5	15.8	1.96 N {0.20 kg}	—	1.57 N {0.16 kg}	

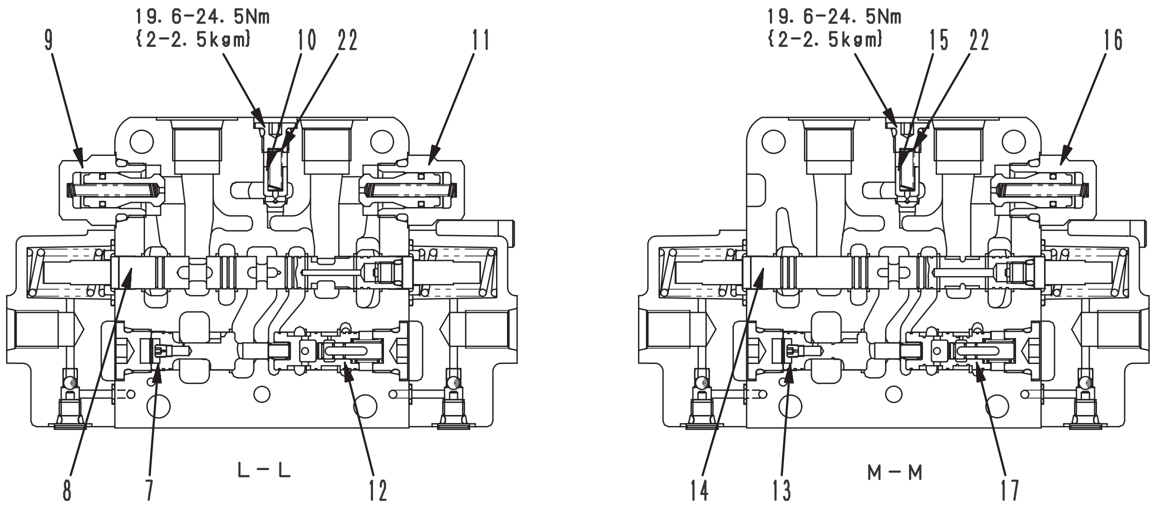
(5/6)



PC35MR－2



PC40MR, 50MR－2



9JY01807

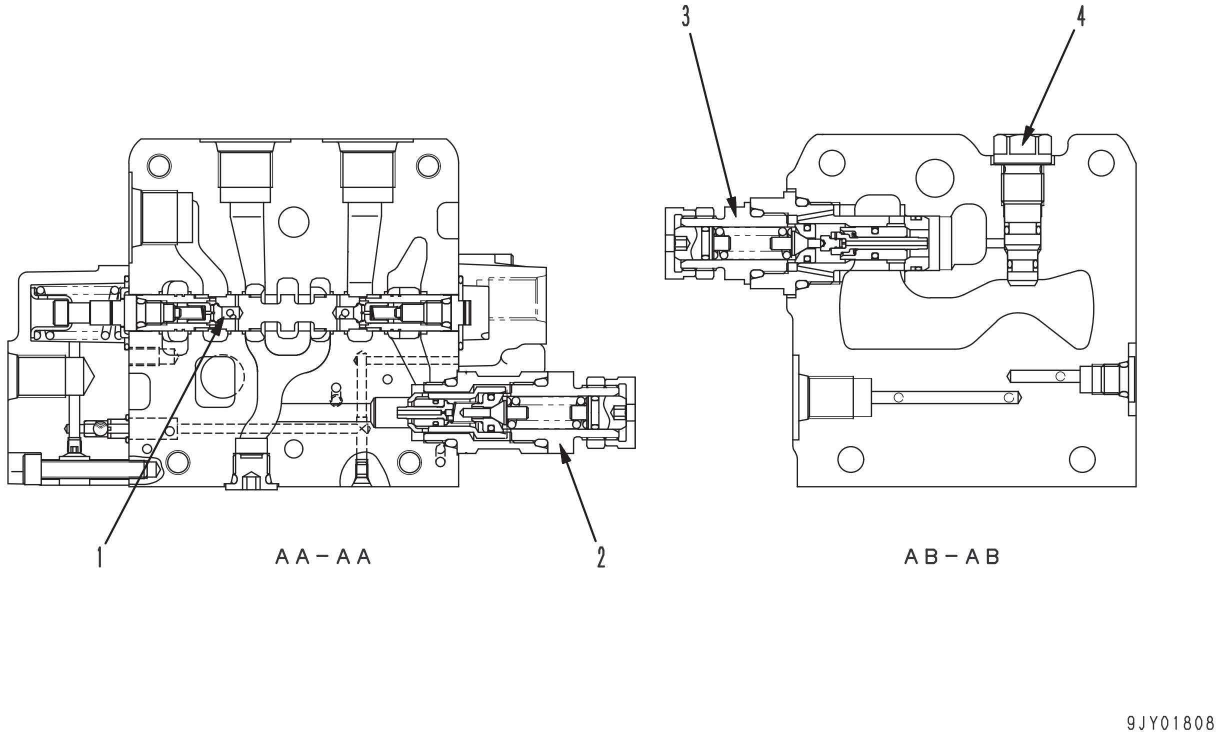
1. Pressure compensation valve (F/Arm)
2. Spool (Arm)
3. Suction valve
4. Check valve
5. Suction valve
6. Pressure compensation valve (R/Arm)
7. Pressure compensation valve (F/Bucket)
8. Spool (Bucket)
9. Suction valve
10. Check valve
11. Suction valve
12. Pressure compensation valve (R/Bucket)
13. Pressure compensation valve (F/Boom swing)
14. Spool (Boom swing)
15. Check valve
16. Suction valve
17. Pressure compensation valve (R/Boom swing)
18. Spool (Blade)
19. Suction valve
20. Check valve
21. Suction valve

F : Flow control valve
R : Pressure reducing valve

Unit: mm

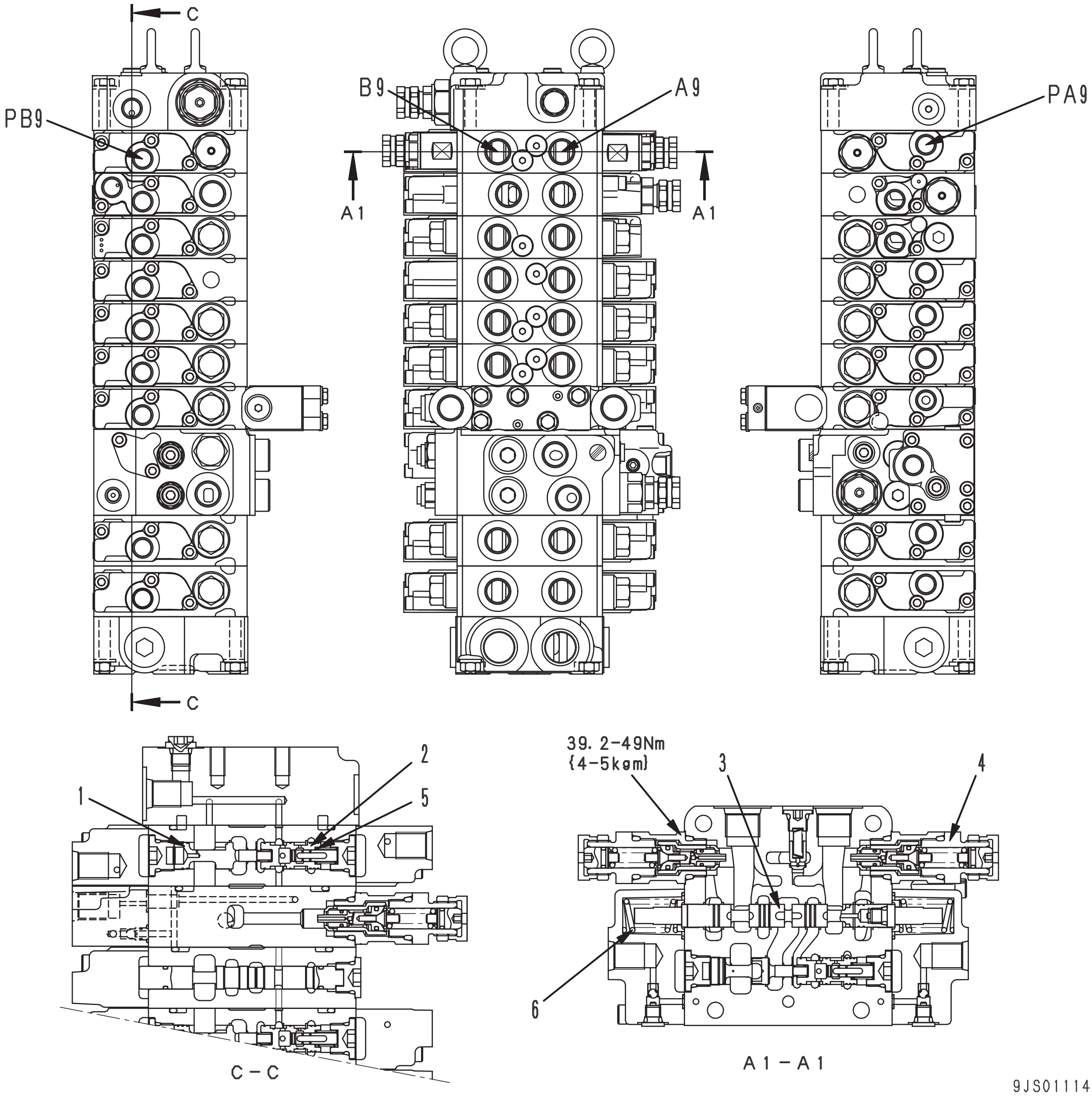
<table>
<tr><th rowspan="3">No.</th><th rowspan="3">Check item</th><th colspan="5">Criteria</th><th rowspan="3">Remedy</th></tr>
<tr><th colspan="3">Standard clearance</th><th colspan="2">Repair limit</th></tr>
<tr><th>Free length x OD</th><th>Installed length</th><th>Installed load</th><th>Free length</th><th>Installed load</th></tr>
<tr><td>22</td><td>Check valve spring
(Arm, bucket, boom swing, blade)</td><td>21.9 x 5.0</td><td>15.8</td><td>1.96 N
{0.20 kg}</td><td>—</td><td>1.57 N
{0.16 kg}</td><td>Replace spring if damaged or deformed</td></tr>
</table>

(6/6)



1. Spool (Swing)
2. Swing relief valve (For gear pump)
3. Safety valve
4. Pressure relief plug

2. 9 spool valve



A9: To stop valve or quick coupler
B9: To stop valve or quick coupler
PA9: To attachment PPC valve
PB9: To attachment PPC valve

1. Pressure compensation valve (F attachment)
2. Pressure compensation valve (R attachment)
3. Spool (Attachment)
4. Port relief valve

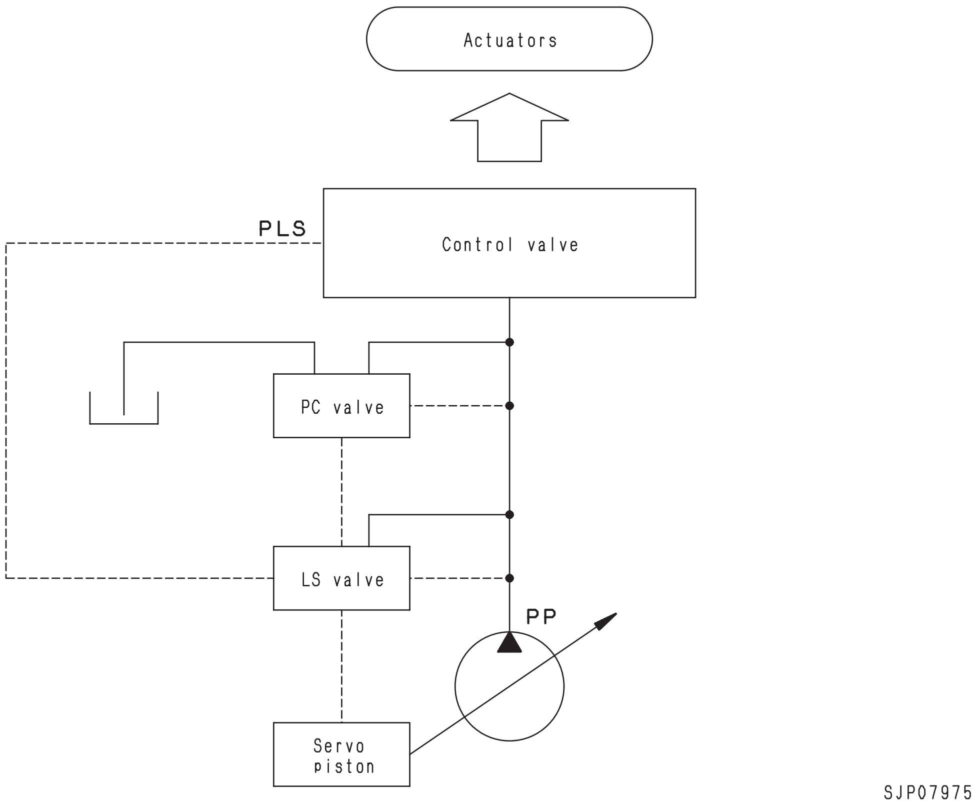
F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
5	Pressure compensation valve spring	20.0 x 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
6	Spool return spring (Attachment)	29.0 x 17.5	28.5	22.6 N {2.30 kg}	—	18.1 N {1.80 kg}	

CLSS

OUTLINE OF CLSS



FEATURES

CLSS stands for Closed center Load Sensing System, and has the following featues.

- Fine control not influenced by load
- Control enabling digging even with fine control
- Ease of compound operation ensured by flow divider function using area of opening of spoll during compund operations
- Energy saving using variable pump control

STRUCTURE

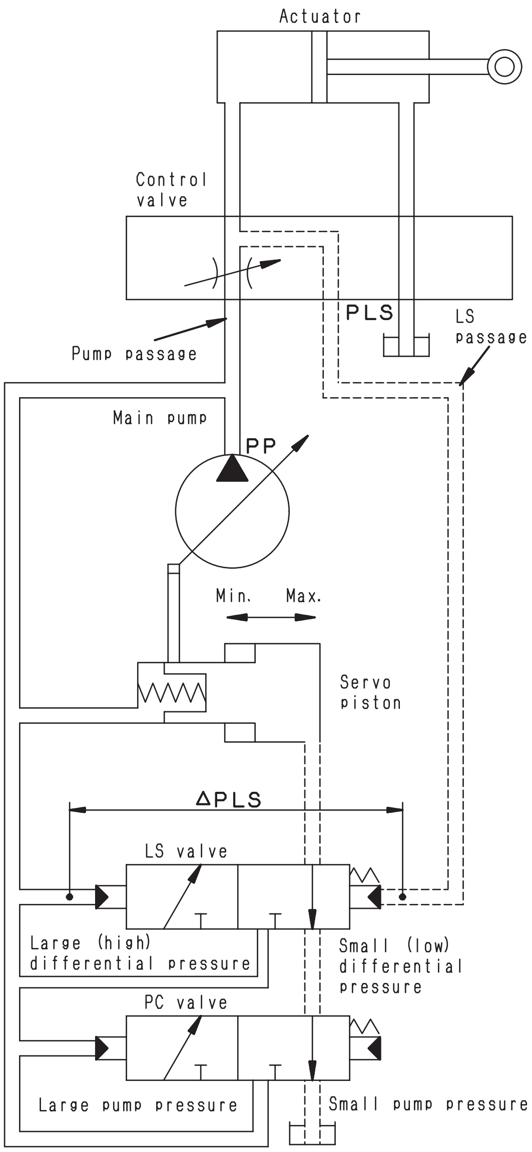
- The CLSS consists of a variable capacity single piston pump, control valve, and actuators.
- The pump body consists of the main pump, PC valve and LS valve.

BASIC PRINCIPLE

1. Control of pump swash plate angle

- The pump swash plate angle (pump discharge amount) is controlled so that LS differential pressure Δ**PLS** (the difference between pump (discharge) pressure **PP** and control valve outlet port LS pressure **PLS**) load pressure of actuator) is constant.

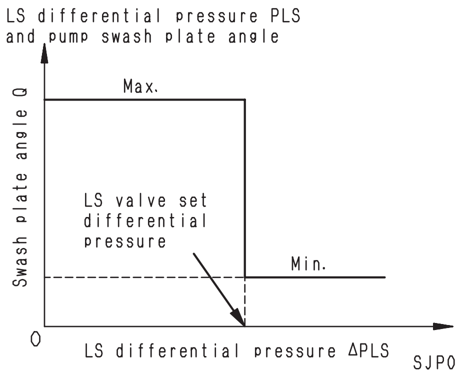
  (LS pressure Δ**PLS**=Pump discharge pressure **PP**-LS pressure **PLS**)



SJP07976

- If LS differential pressure Δ**PLS** becomes lower than the set pressure of the LS valve (when the actuator load pressure is high), the pump swash plate moves towards the maximum position; if the set pressure becomes higher than the set pressure of the LS valve (when the actuator load pressure is low), the pump swash plate moves towards the minimum position.

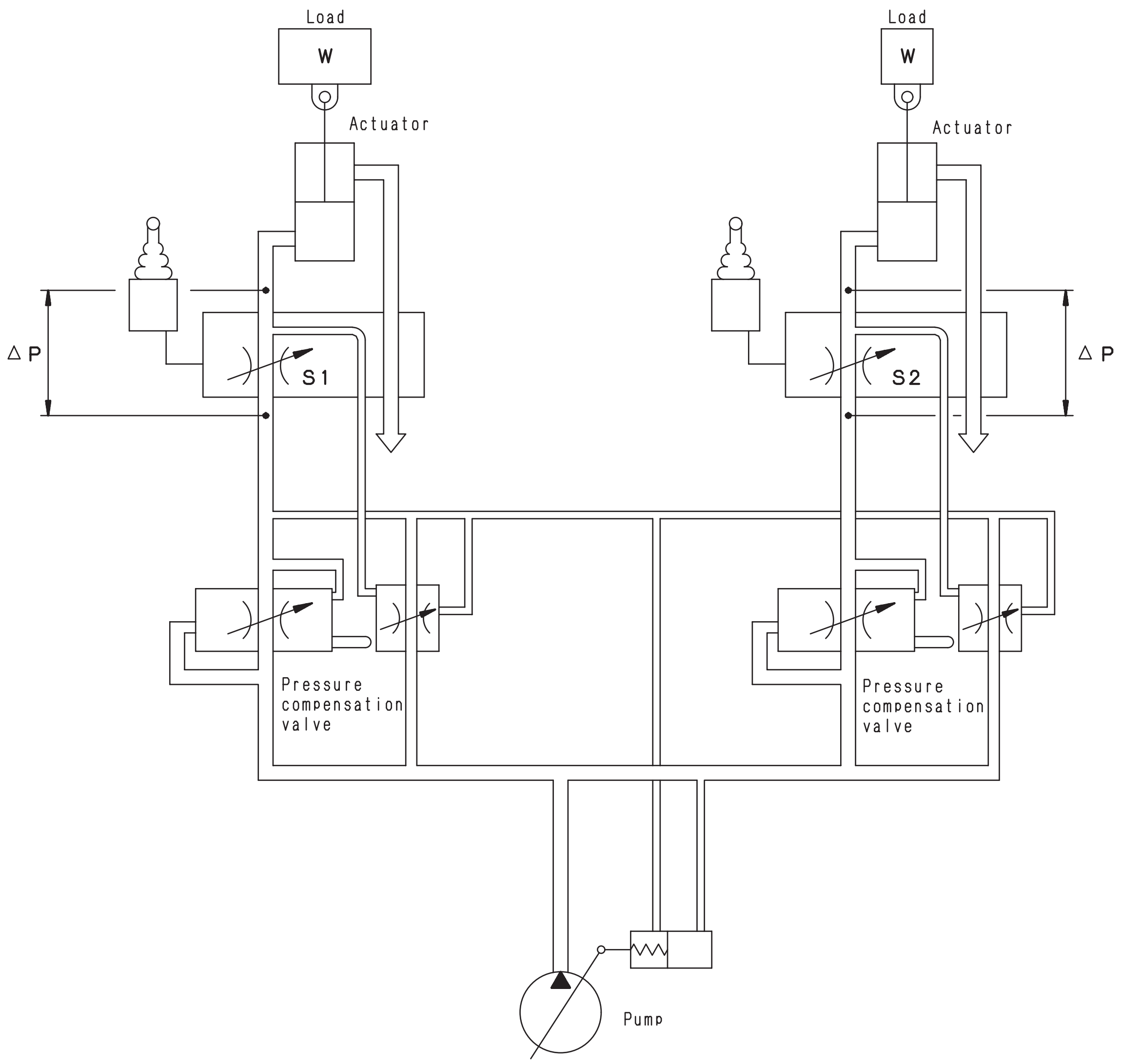
★ For details of the operation, see HYDRAULIC PUMP.



SJP07977

2. Pressure compensation control

- A pressure compensation valve is installed to the outlet port side of the control valve spool to balance the load.
  When to actuators are operated together, this valve acts to make pressure difference Δ**P** between the upstream (inlet port) and downstream (outlet port) the same, regardless of the size of the load (pressure). In this way, the flow of oil from the pump is divided (compensated) in proportion to the area of openings **S1** and **S2** of each valve when it is operated.



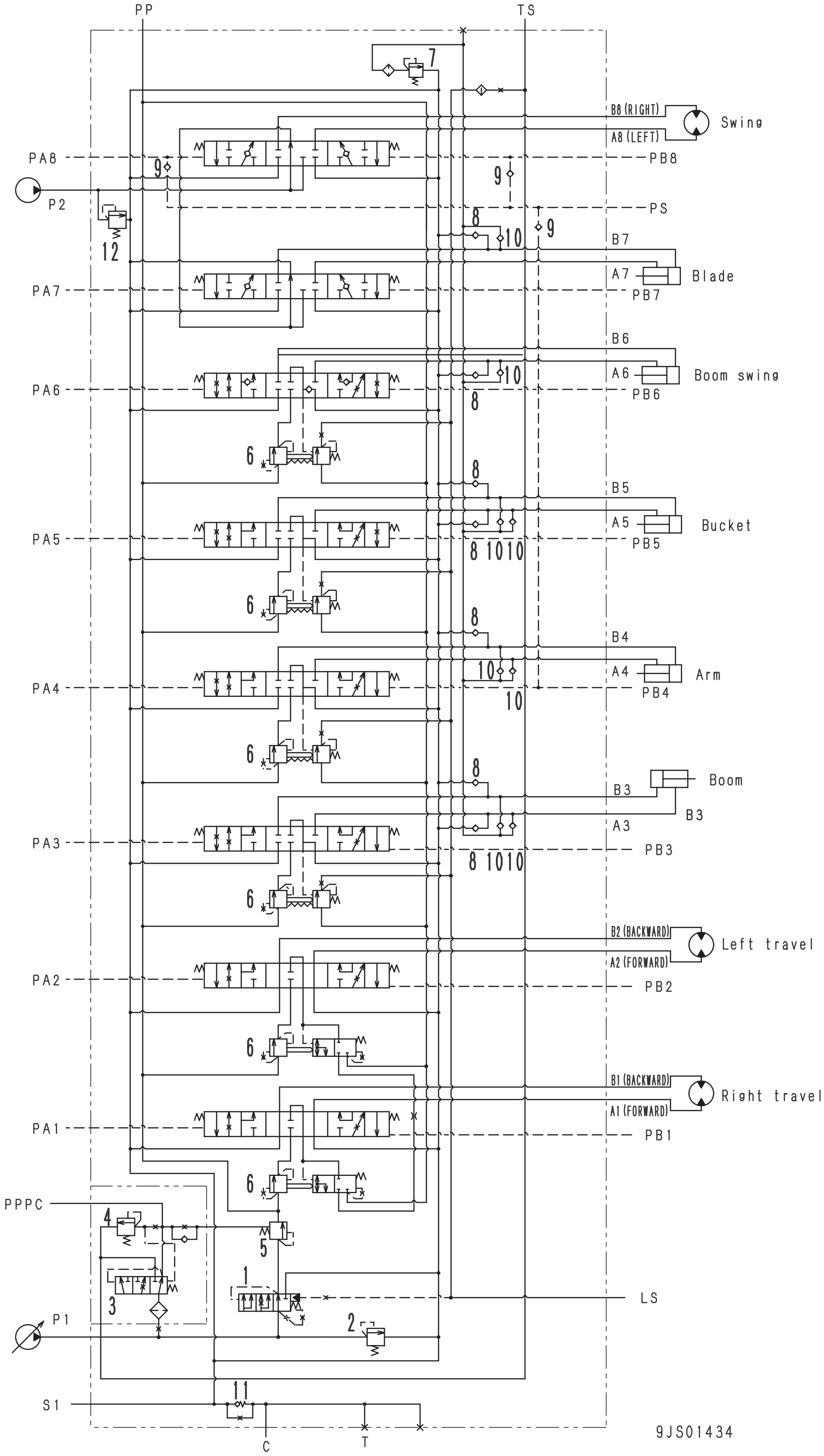
SJP07978

OPERATION FOR EACH FUNCTION AND VALVE

HYDRAULIC CIRCUIT DIAGRAM AND NAME OF VALVE

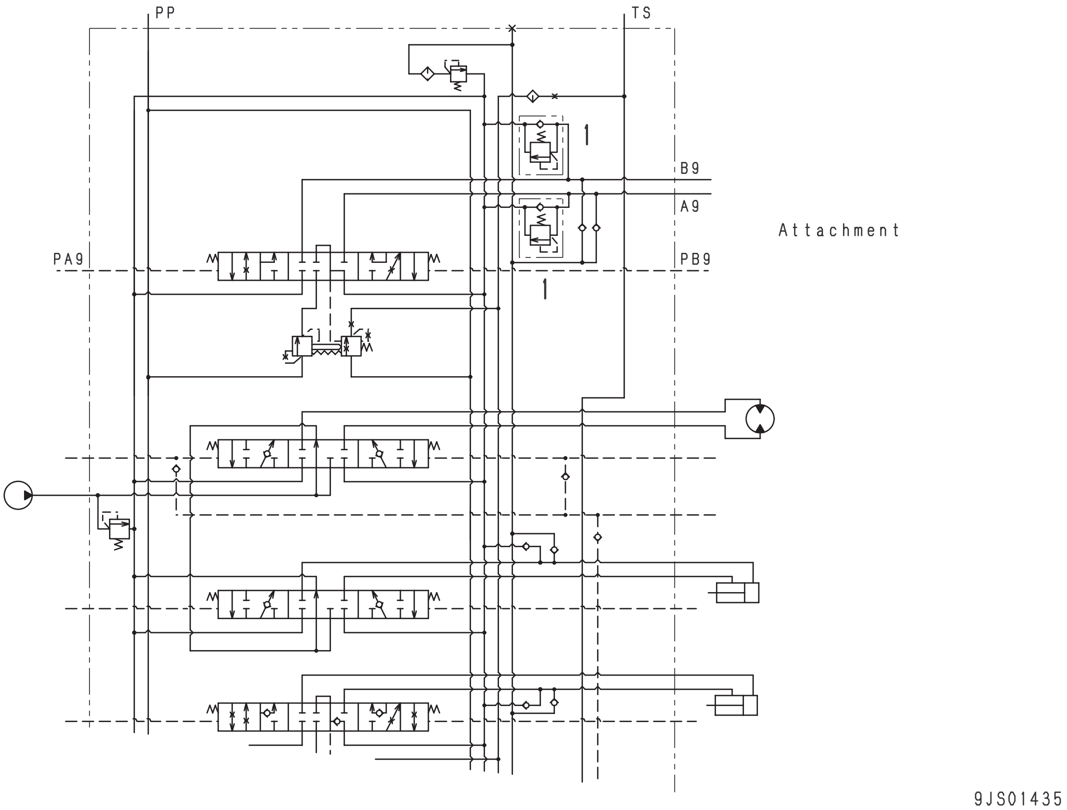
PC27MR-2

1. 8 Spool valve



1. Unload valve
   Set pressure : LS pressure + 3.4 MPa
   {35.0 kg/cm²}
2. Main relief valve
   Set pressure : 24.5 MPa {250 kg/cm²}
3. Self pressure reducing valve
4. Pilot relief valve
   Set pressure : 2.90 MPa {30.0 kg/cm²}
5. Self pressure sequence valve
   Set pressure :
   2.90 to 3.40 MPa {30.0 to 35.0 kg/cm²}
6. Pressure compensation valve
7. Safety valve
   Set pressure : 27.9 MPa {285 kg/cm²}
8. Suction valve
9. Pilot pressure check valve
10. Check valve
11. Back pressure check valve
    Set pressure : 0.34 MPa {3.5 kg/cm²}
12. Swing relief valve
    (for gear pump)
    Set pressure : 21.1 MPa {215 kg/cm²}

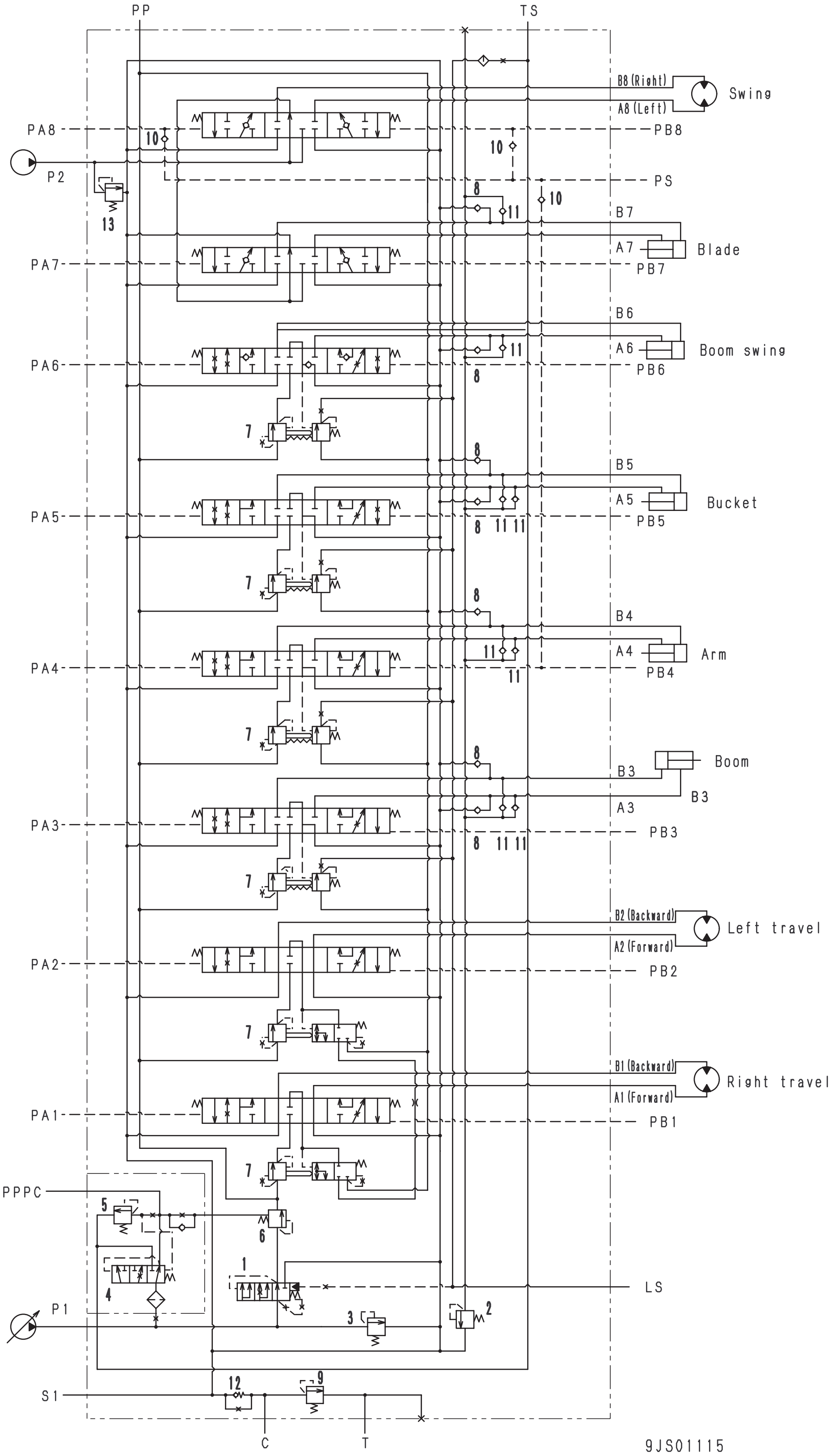
2. 9 spool valve



1. Port relief valve
   Set pressure: 17.2 MPa {175 kg/cm²}

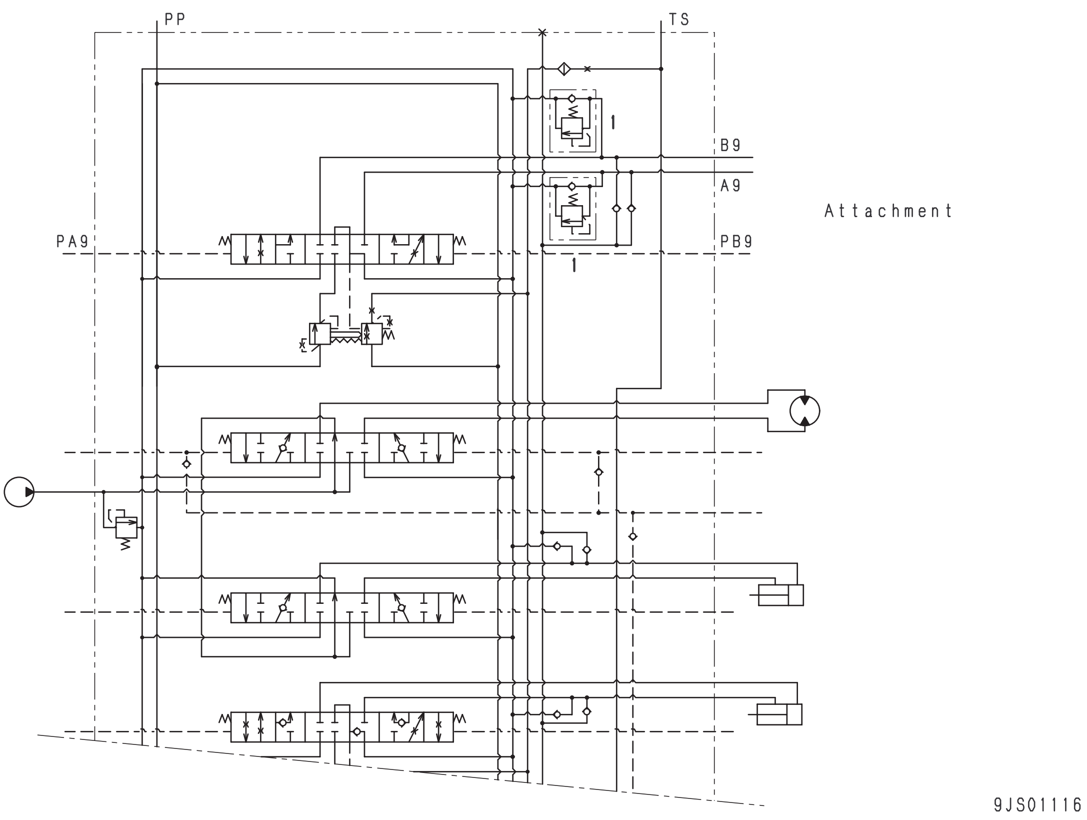
PC30MR-2

1. 8 Spool valve



1. Unload valve
   Set pressure : LS pressure + 3.70 MPa
   {38.0 kg/cm^2}
2. Safety valve
   Set pressure : 27.9 MPa {285 kg/cm^2}
3. Main relief valve
   Set pressure : 26.0 MPa {265 kg/cm^2}
4. Self pressure reducing valve
5. Pilot relief valve
   Set pressure : 2.90 MPa {30.0 kg/cm^2}
6. Self pressure sequence valve
   Set pressure :
   2.90 to 3.40 MPa {30.0 to 35.0 kg/cm^2}
7. Pressure compensation valve
8. Suction valve
9. Oil cooler bypass valve
   Set pressure : 0.40 MPa {4.0 kg/cm^2}
10. Pilot pressure check valve
11. Check valve
12. Back pressure check valve
    Set pressure : 0.34 MPa {3.5 kg/cm^2}
13. Swing relief valve
    (for gear pump)
    Set pressure : 21.1 MPa {215 kg/cm^2}

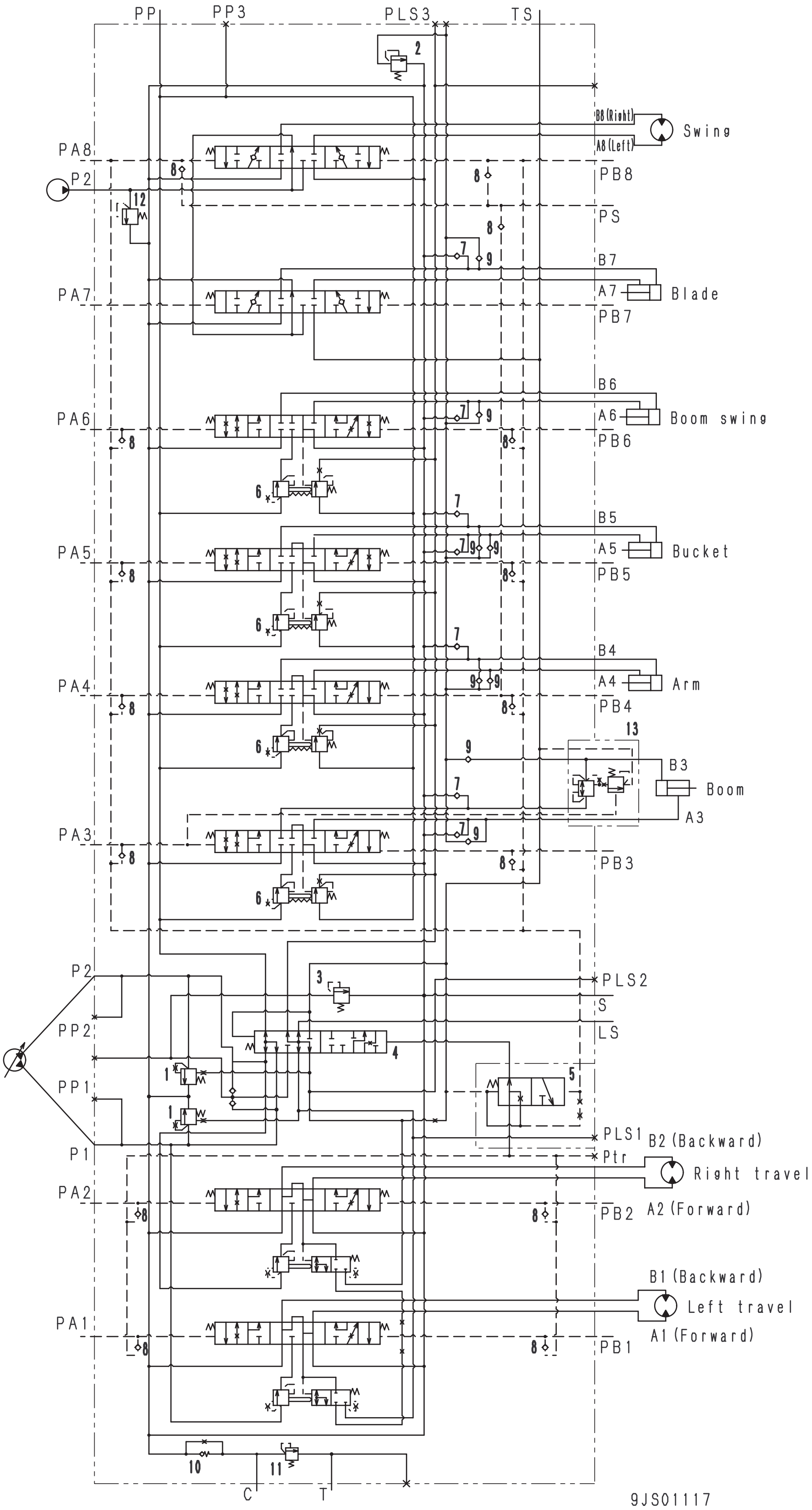
2. 9 spool valve



1. Port relief valve
   Set pressure: 20.6 MPa {210 kg/cm^2}

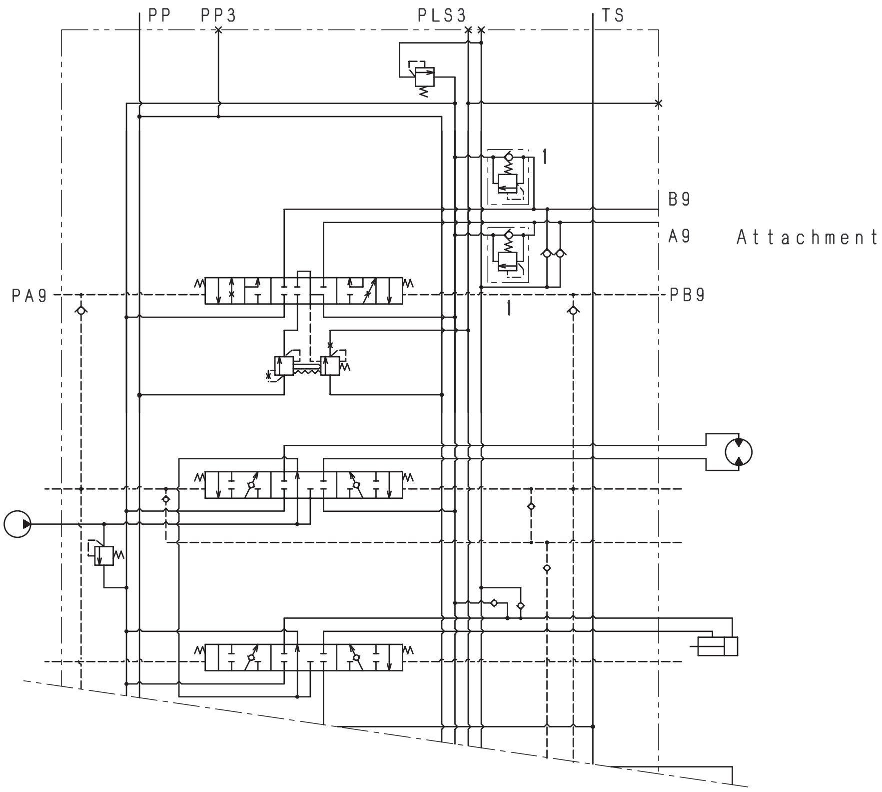
PC35MR-2

1. 8 spool valve



1. Unload valve
   Set pressure :
   LS pressure + 2.45 MPa {25.0 kg/cm^2}
2. Safety valve
   Set pressure : 28.0 MPa {285 kg/cm^2}
3. Main relief valve
   Set pressure : 26.0 MPa {265 kg/cm^2}
4. Merge-divider valve
5. Logic valve
6. Pressure compensation valve
7. Suction valve
8. Pilot pressure check valve
9. Check valve
10. Back pressure check valve
    Set pressure : 0.34 MPa {3.5 kg/cm^2}
11. Oil cooler bypass valve
    Set pressure : 0.39 MPa {4.0 kg/cm^2}
12. Swing relief valve
    (for gear pump)
    Set pressure : 21.6 MPa {220 kg/cm^2}
13. Boom lock valve

2. 9 spool valve

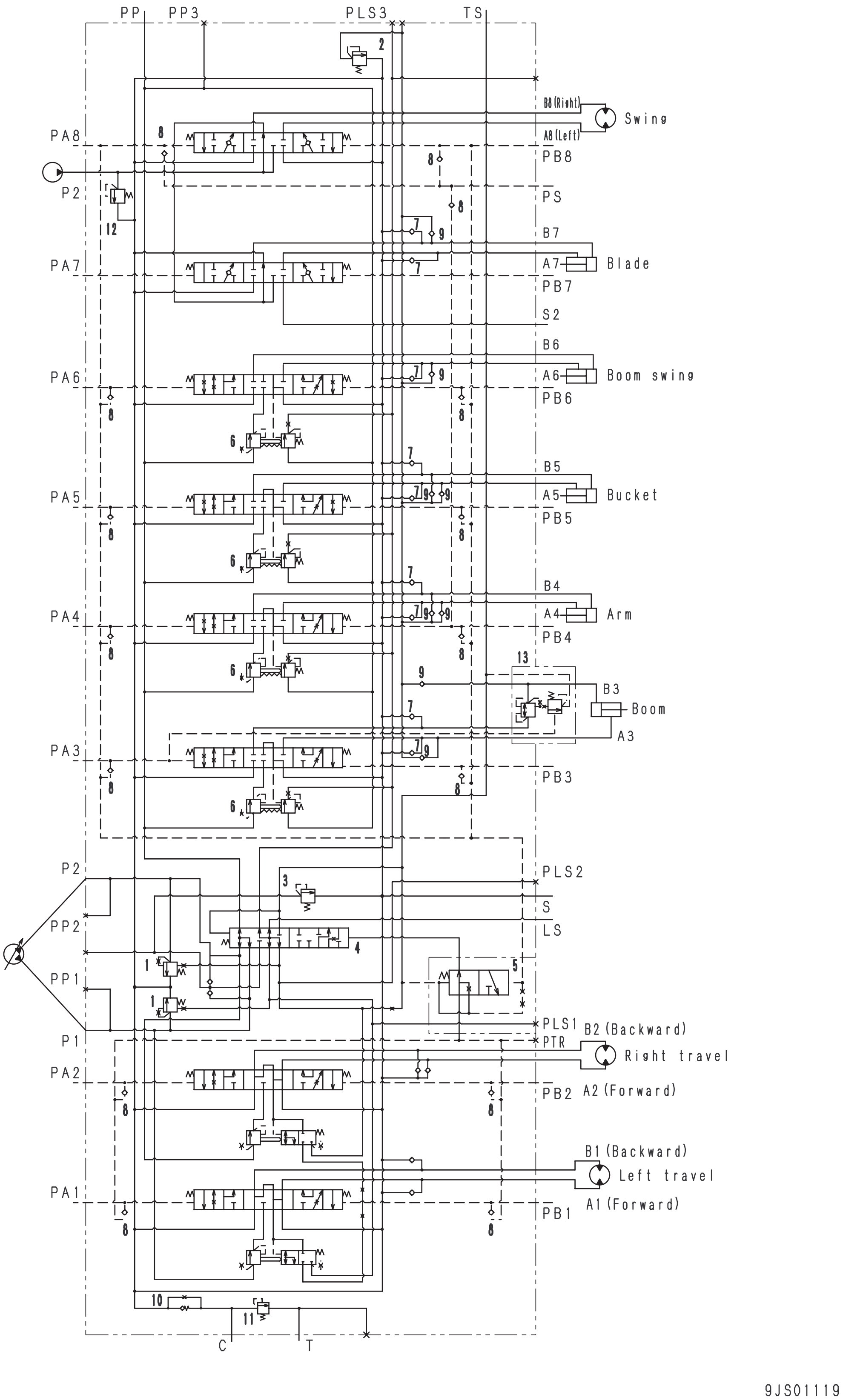


9JS01118

1. Port relief valve
   Set pressure: 17.2 MPa {175 kg/cm^2}

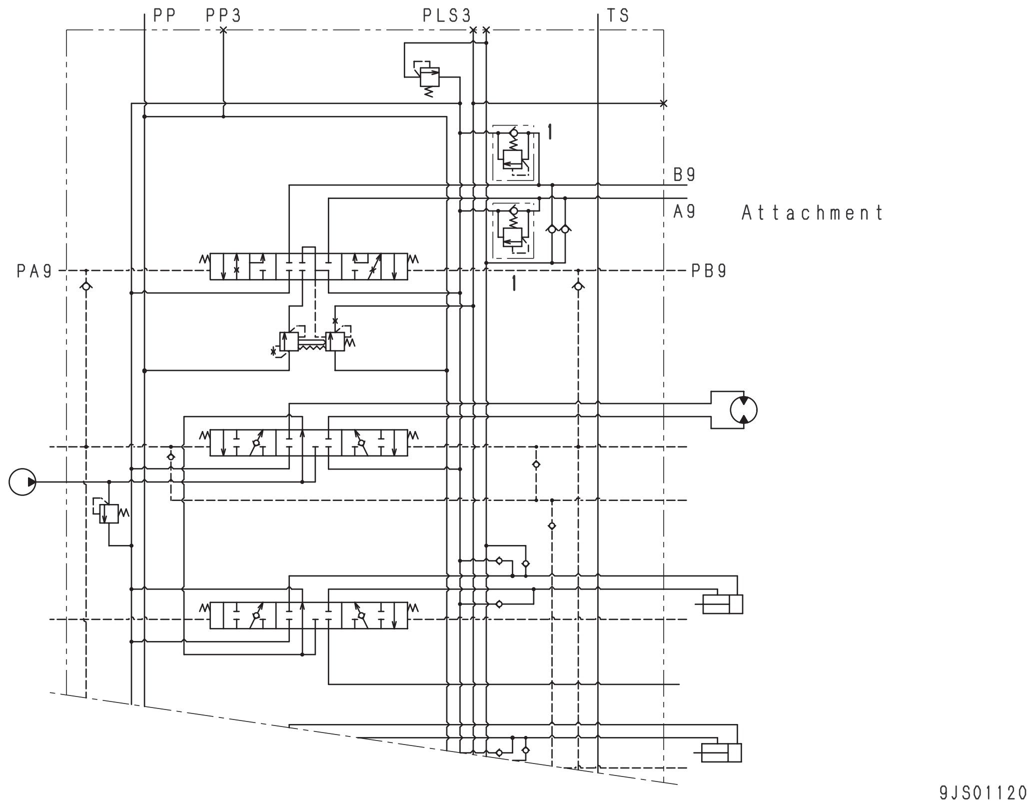
PC40MR, 50MR-2

1. 8 spool valve



1. Unload valve
   Set pressure :
   LS pressure + 2.45 MPa {25.0 kg/cm^2}
2. Safety valve
   Set pressure : 28.0 MPa {285 kg/cm^2}
3. Main relief valve
   Set pressure : 26.0 MPa {265 kg/cm^2}
4. Merge-divider valve
5. Logic valve
6. Pressure compensation valve
7. Suction valve
8. Pilot pressure check valve
9. Check valve
10. Back pressure check valve
    Set pressure : 0.34 MPa {3.5 kg/cm^2}
11. Oil cooler bypass valve
    Set pressure : 0.39 MPa {4.0 kg/cm^2}
12. Swing relief valve
    (for gear pump)
    Set pressure : 21.6 MPa {220 kg/cm^2}
13. Boom lock valve

2. 9 spool valve

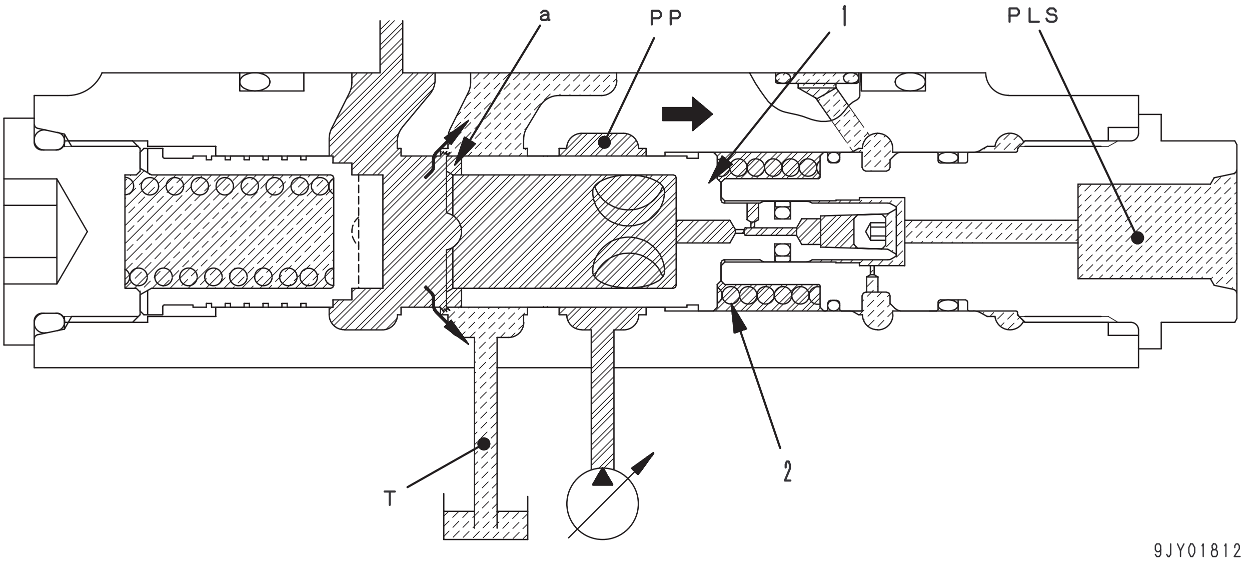


1. Port relief valve
   Set pressure (with stop valve): 20.6 MPa {210 kg/cm^2}
   Set pressure (with quick coupler): 17.2 MPa {175 kg/cm^2}

UNLOAD VALVE

PC27MR, 30MR-2

1. When control valve is at neutral



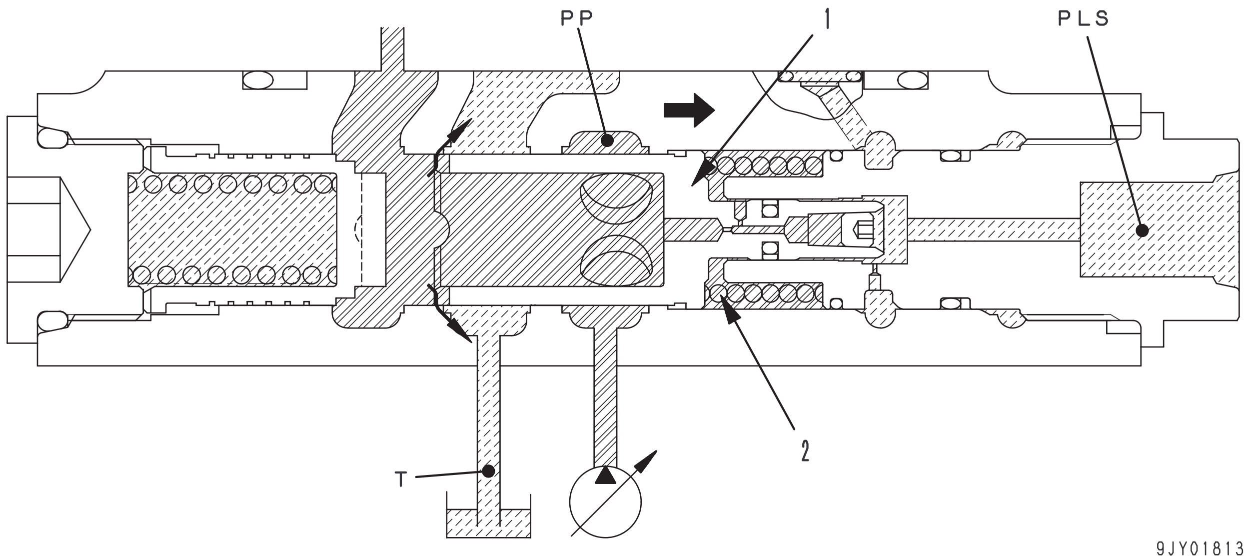
PP : Pump circuit (pressure)
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

FUNCTION
- When the control valve is at neutral, pump discharge amount **Q** discharged by the minimum swash plate angle is released to the tank circuit. When this happens, pump discharge pressure **PP** is set at 3.43 MPa {35 kg/cm^2} by spring (2) inside the valve. (LS pressure **PLS** : 0 MPa {0 kg/cm^2}.

OPERATION
- Pump discharge pressure **PP** is acting on the left end of spool, and LS pressure **PLS** is acting on the right end.
- When the control valve is at neutral, LS pressure **PLS** is 0, so only pump discharge pressure **PP** has any effect, and **PP** is set only by the load of spring (2).
- As pump discharge pressure **PP** rises and reaches the load of spring (2) (3.43 MPa {35 kg/cm^2}), spool (1) is moved to the right in the direction. Pump discharge pressure **PP** then passes through the notch **a** of spool (1) and is connected to tank circuit **T**.
- In this way, pump discharge pressure **PP** is set to 3.43 MPa {35 kg/cm^2}.

2. When control valve is in fine control



PP : Pump circuit (pressure)
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

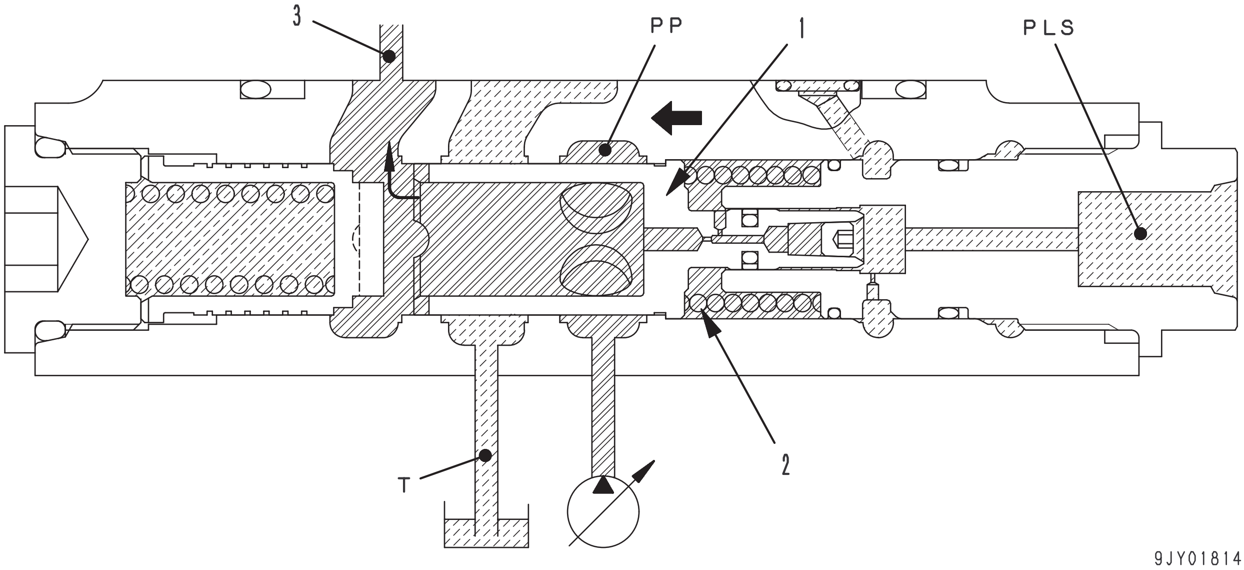
FUNCTION

- When the control valve is in the fine control mode, if the demand flow for actuator is less than the value corresponding to the minimum swash plate angle of the pump, pump pressure **PP** is set to LS pressure **PLS** + 3.43 MPa {35.0 kg/cm^2}. If the difference pressure between pump pressure **PP** and LS pressure **PLS** becomes equal to the load of spring (2) (3.43 MPa {35.0 kg/cm^2}), the unload valve opens. Accordingly, LS differential pressure Δ**PLS** is (3.43 MPa {35.0 kg/cm^2}) at this time.

OPERATION

- When fine control is carried out on the control valve, LS pressure **PLS** is generated and acts on the right end of spool (1).
  When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure **PLS** and pump discharge pressure **PP**.
- When the differential pressure between pump discharge pressure **PP** and LS pressure **PLS** reaches the load of spring (2) (3.43MPa {35 kg/cm^2}, spool (1) moves to the right in the direction of the arrow, and pump circuit **PP** and tank circuit **T** are connected.
- In other words, pump discharge pressure **PP** is set to a pressure equal to the spring force (3.43 MPa {35 kg/cm^2}) + LS pressure **PLS**, and LS differential pressure Δ**PLS** becomes 3.43 MPa {35 kg/cm^2}.

3. When control valve is being operated (work equipment)



PP : Pump circuit (pressure)
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring
3. Actuator circuit

FUNCTION

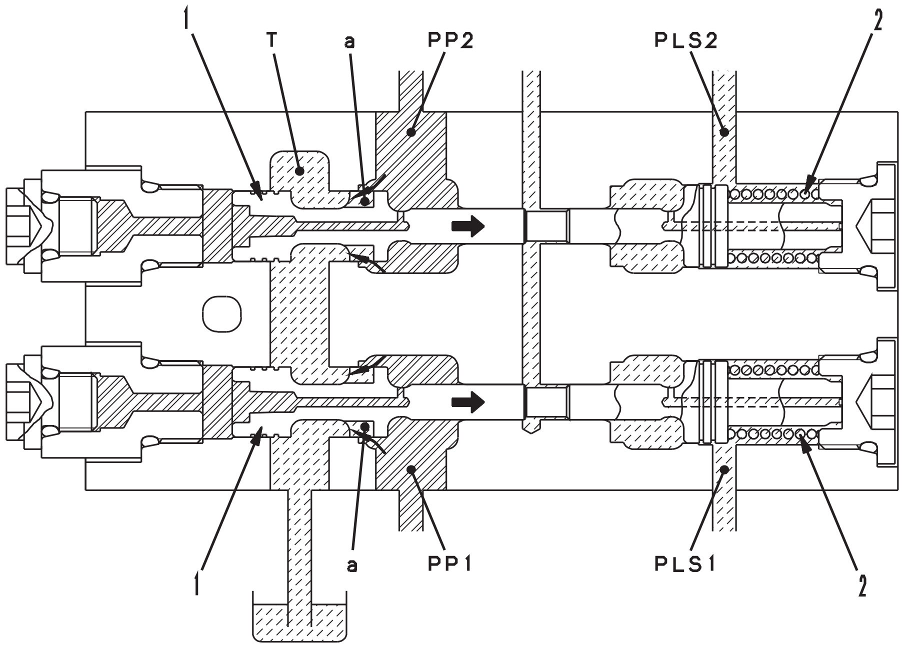
- When the control valve is operated, if the demand flow for actuator exceeds the value corresponding to the minimum swash plate angle of the pump, the outflow to tank circuit **T** is shut off and all of pump discharge amount **Q** is sent to the actuator circuit.

OPERATION

- When the control valve is operated to a bigger stroke, LS pressure **PLS** is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure **PLS** and pump discharge pressure **PP** is small.
- For this reason, the differential pressure between pump discharge pressure **PP** and LS pressure **PLS** does not reach the load of spring (2) (3.43 MPa {35 kg/cm^2}), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit **PP** and tank circuit **T** are shut off, and all the pump discharge amount **Q** flows to the actuator circuit (3).

PC35MR, 40MR, 50MR-2

1. When control valve is at neutral



PP1, PP2 : Pump circuit (pressure)
PLS1, PLS2: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

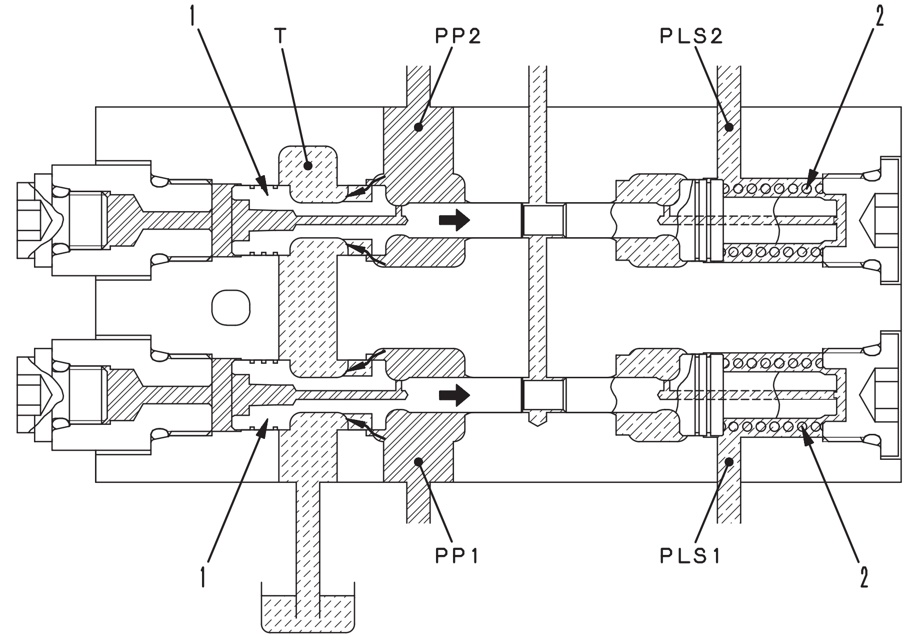
FUNCTION

- When the control valve is at neutral, pump discharge amount **Q** discharged by the minimum swash plate angle is released to the tank circuit. When this happens, pump discharge pressure **PP1**, **PP2** is set at 2.45 MPa {25 kg/cm^2} by spring (2) inside the valve. (LS pressure **PLS1**, **PLS2** : 0 MPa {0 kg/cm^2}

OPERATION

- Pump discharge pressure **PP1**, **PP2** is acting on the left end of spool (1), and LS pressure **PLS1**, **PLS2** is acting on the right end.
- When the control valve is at neutral, LS pressure **PLS1**, **PLS2** is 0, so only pump discharge pressure **PP1**, **PP2** has any effect, and **PP1**, **PP2** is set only by the load of spring (2).
- As pump discharge pressure **PP1**, **PP2** rises and reaches the load of spring (2) (2.45 MPa {25 kg/cm^2}), spool (1) is moved to the right in the direction of the arrow. Pump discharge pressure **PP1**, **PP2** then passes through the notch a in spool (1) and is connected to tank circuit **T**.
- In this way, pump discharge pressure **PP1**, **PP2** is set to 2.45 MPa {25 kg/cm^2}.

2. When control valve is in fine control



PP1, PP2 : Pump circuit (pressure)
PLS1, PLS2: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

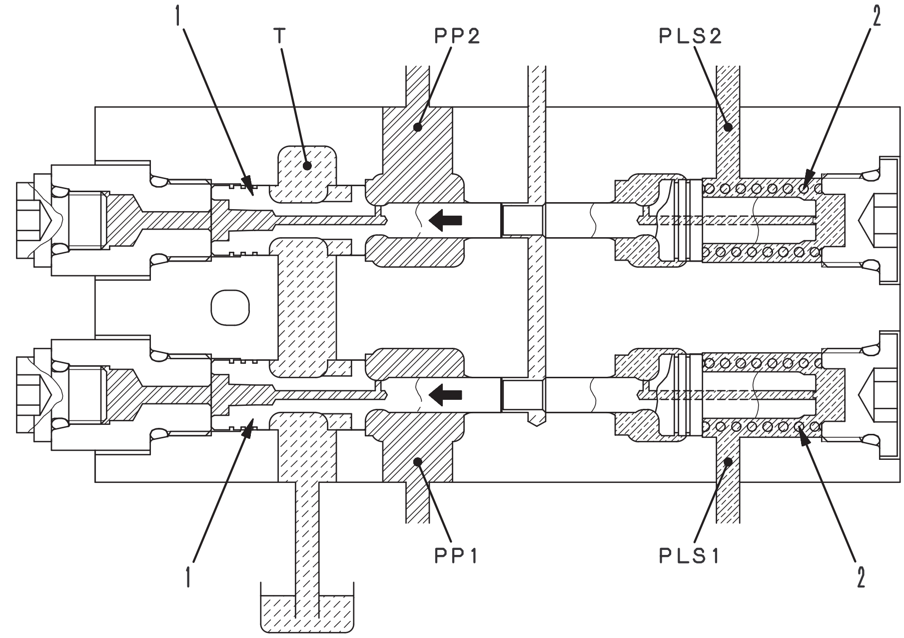
FUNCTION

- When the control valve is in the fine control mode, if the demand flow for actuator is less than the value corresponding to the minimum swash plate angle of the pump, pump pressure **PP1**, **PP2** is set to LS pressure **PLS1**, **PLS2** + 2.45 MPa {25.0 kg/cm^2}. If the difference pressure between pump pressure **PP1**, **PP2** and LS pressure **PLS1**, **PLS2** becomes equal to the load of spring (2) (2.45 MPa {25.0 kg/cm^2}), the unload valve opens. Accordingly, LS differential pressure Δ**PLS** is (2.45 MPa {25.0 kg/cm^2}) at this time.

OPERATION

- When fine control is carried out on the control valve, LS pressure **PLS1**, **PLS2** is generated and acts on the right end of spool (1).
  When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure **PLS1**, **PLS2** and pump discharge pressure **PP1**, **PP2**.
- When the differential pressure between pump discharge pressure **PP1**, **PP2** and LS pressure **PLS1**, **PLS2** reaches the load of spring (2) (2.45 MPa {25 kg/cm^2}, spool (1) moves to the right in the direction of the arrow, and pump circuit **PP1**, **PP2** and tank circuit **T** are connected.
- In other words, pump discharge pressure **PP1**, **PP2** is set to a pressure equal to the spring force (2.45 MPa {25 kg/cm^2}) + LS pressure **PLS1**, **PLS2** and LS differential pressure Δ**PLS** becomes 2.45 MPa {25 kg/cm^2}.

3. When control valve is in being operated (work equipment)



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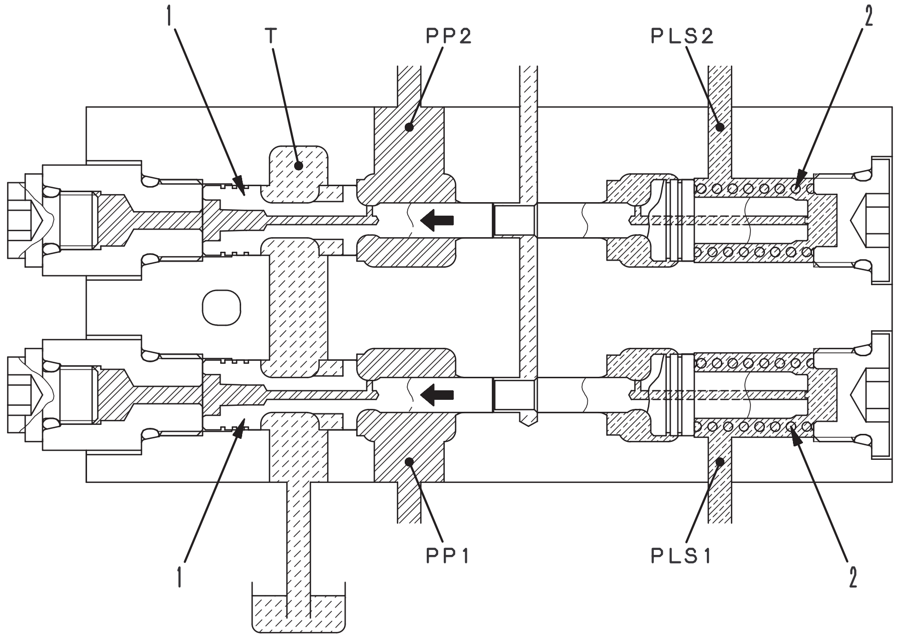
PP1, PP2 : Pump circuit (pressure)
PLS1, PLS2: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

FUNCTION
- When the control valve is operated, if the demand flow for actuator exceeds the value corresponding to the minimum swash plate angle of the pump, the outflow to tank circuit **T** is shut off and all of pump discharge amount **Q1**, **Q2** is sent to the actuator circuit.

OPERATION
- When the control valve is operated to a bigger stroke, LS pressure **PLS1**, **PLS2** is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure **PLS1**, **PLS2** and pump discharge pressure **PP1**, **PP2** is small.
- For this reason, the differential pressure between pump discharge pressure **PP1**, **PP2** and LS pressure **PLS1**, **PLS2** does not reach the load of spring (2) (2.45 MPa {25 kg/cm^2}), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit **PP1**, **PP2** and tank circuit **T** are shut off, and all the pump discharge amount **Q1**, **Q2** flows to the actuator circuit.

4. When travel control valve is operated (singly)



PP1, PP2 : Pump circuit (pressure)
PLS1, PLS2: LS circuit (pressure)
T : Tank circuit (pressure)

1. Spool
2. Spring

FUNCTION

- When the machine travels, the swash plate angle of the pump becomes maximum. At this time, the oil flow is controlled according to the opening rate of the spool.

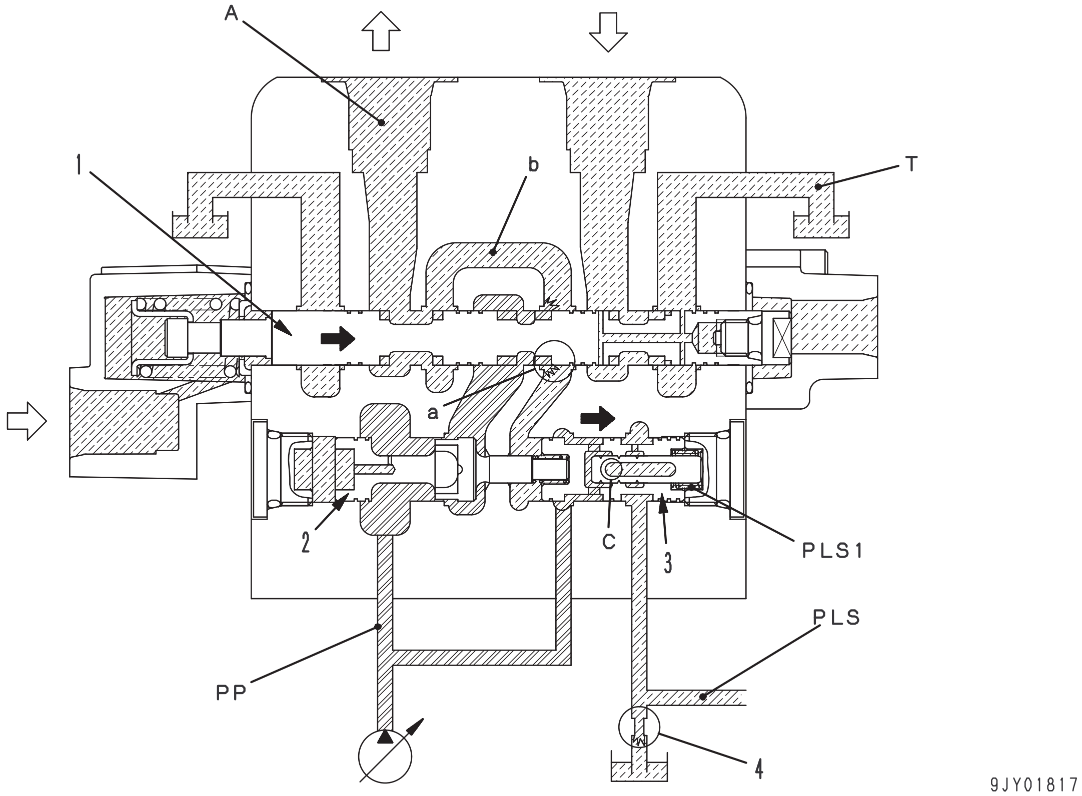
OPERATION

- When the travel control valve is operated singly, the control valve is separated by the junction valve.
- As a result, the unload valves on **PP1** and **PP2** sides operate according to the opening rate of the travel spools on both sides.

INTRODUCTION OF LS PRESSURE

PC27MR, 30MR-2

1. Work equipment valve (boom, arm, bucket, boom swing, travel)



FUNCTION

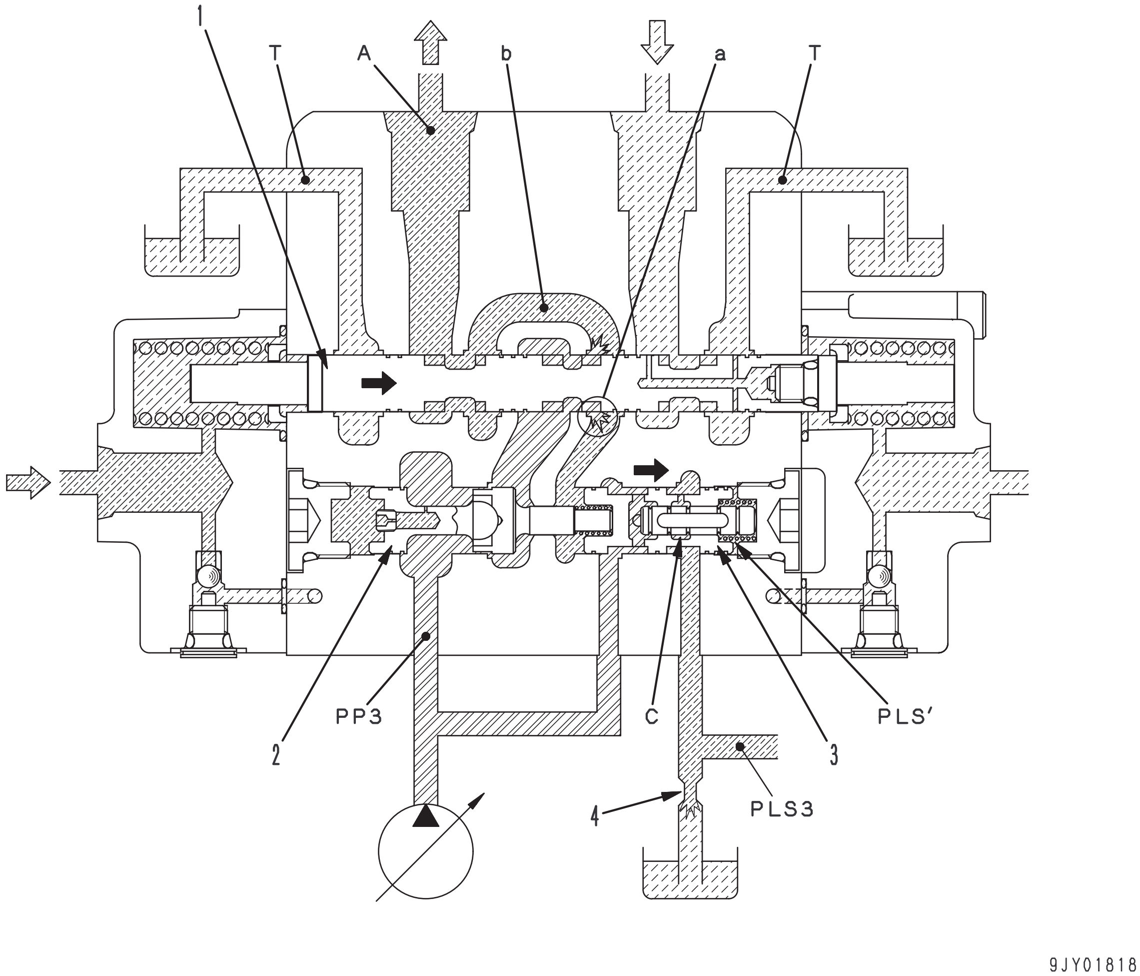
- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- With the control valve, it actually reduces pump pressure **PP** at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure **A**, and sends it to the LS circuit **PLS**.

OPERATION

- When spool (1) operated, pump pressure **PP** flows from flow control valve (2) and notch **a** in the spool through bridge passage **b** to actuator circuit **A**.
- At the same time, reducing valve (3) also moves to the right, so pump pressure **PP** is reduced by the pressure loss at notch **c**, and then applied though LS circuit **PLS** to spring chamber **PLS1**.
- When this happens, LS circuit **PLS** is connected to tank circuit **T** from LS bypass plug (4) (see the section on the LS bypass plug).
- The actuator circuit pressure **A** acts on the left end of reducing valve (3). The reduced pump pressure **PP** acts on at the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure **A** and the pressure of spring chamber **PLS1** are the same. Pump pressure **PP** reduced at notch a becomes actuator circuit pressure **A** and is taken to LS circuit **PLS**.

PC35MR, 40MR, 50MR-2

1. Work equipment valve (boom, arm, bucket, boom swing)



FUNCTION

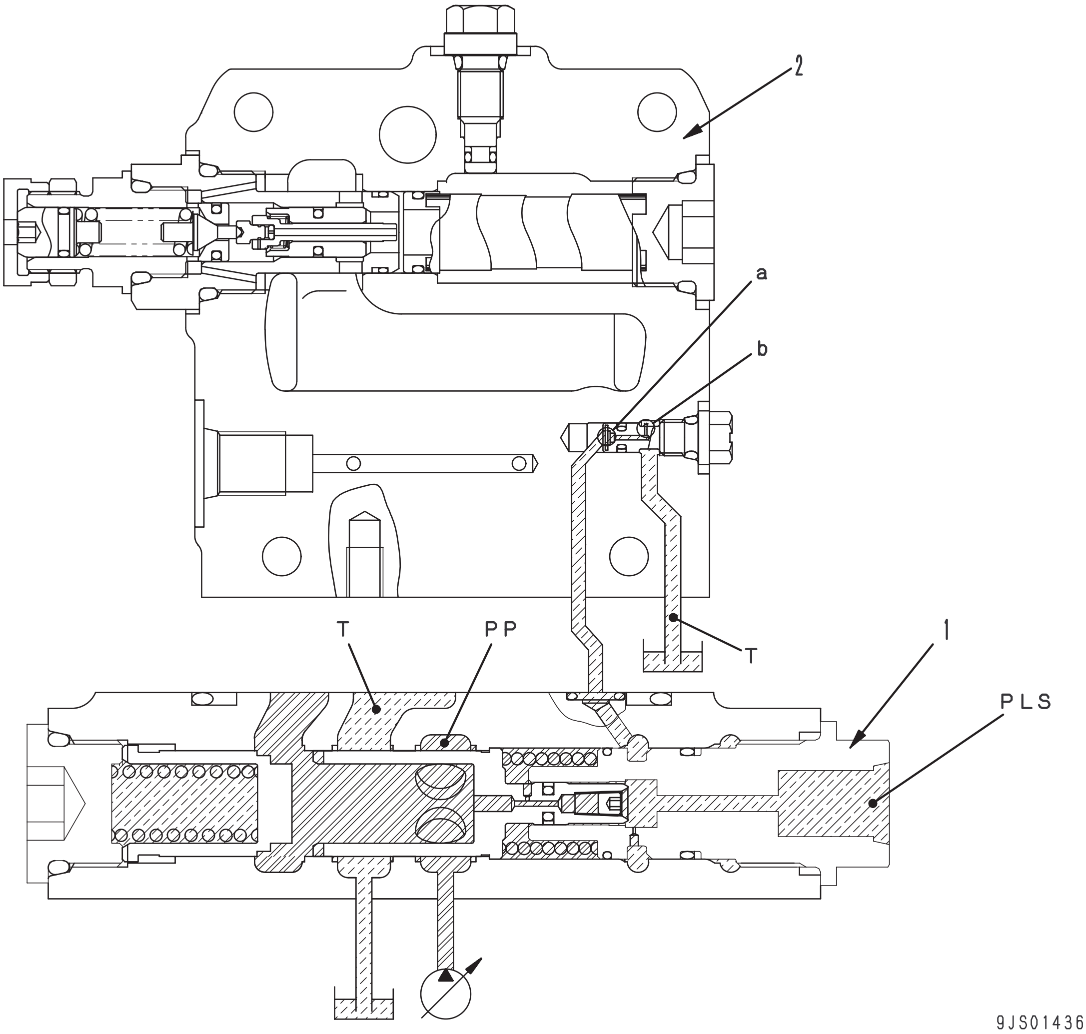
- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- With the control valve, it actually reduces pump pressure **PP3** at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure **PA** (=**A**), and sends it to the LS circuit **PLS3**.

OPERATION

- When spool (1) is operated, pump pressure **PP3** flows from flow control valve (2) and notch **a** in the spool through bridge passage **b** to actuator circuit **A.**
- At the same time, reducing valve (3) also moves to the right, so pump pressure **PP3** brought from orifice c has its pressure reduced by the pressure loss at notch **c**. It goes to LS circuit **PLS3**, and then goes to spring chamber **PLS'**.
- When this happens, LS circuit **PLS3** is connected to tank circuit **T** from LS bypass plug (4) (see the section on the LS bypass plug).
- The actuator circuit pressure **A** acts on the left end of reducing valve (3). The reduced pump pressure **PP3** acts on at the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure **A** and the pressure of spring chamber **PLS'** are the same. Pump pressure **PP3** reduced at notch **a** becomes actuator circuit pressure **A** and is taken to LS circuit **PLS3**.

LS BYPASS PLUG

PC27MR-2



PLS: LS circuit (pressure)
T : Tank circuit (pressure)

1. LS bypass plug
2. Valve cover

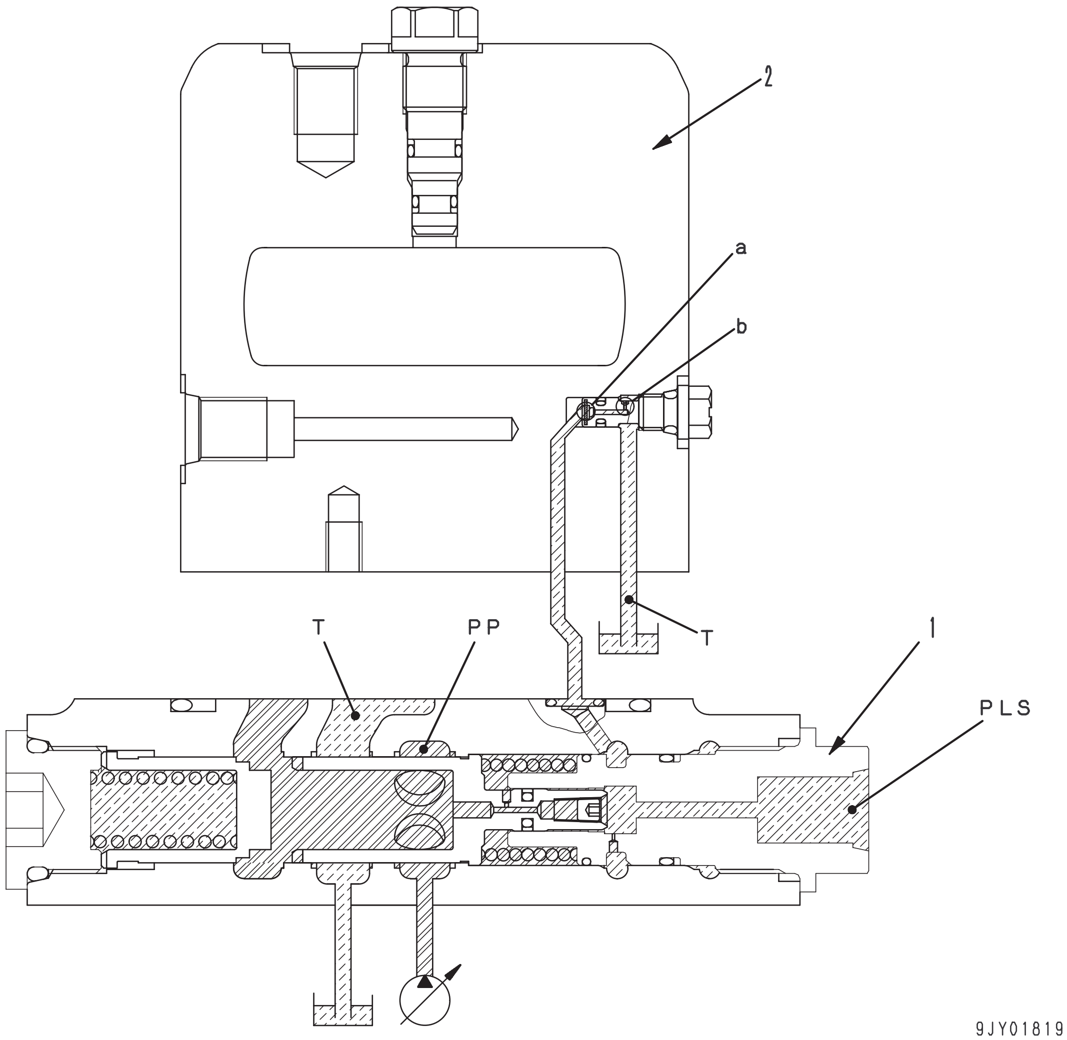
FUNCTION

- This releases the residual pressure of LS pressure **PLS**.
- It makes the speed of the rise in pressure of LS pressure **PLS** more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.

OPERATION

- The pressurized oil for LS circuit **PLS** passes from filter **a** of bypass plug (1) through orifice **b** and flows to the tank circuit **T**.

PC30MR-2



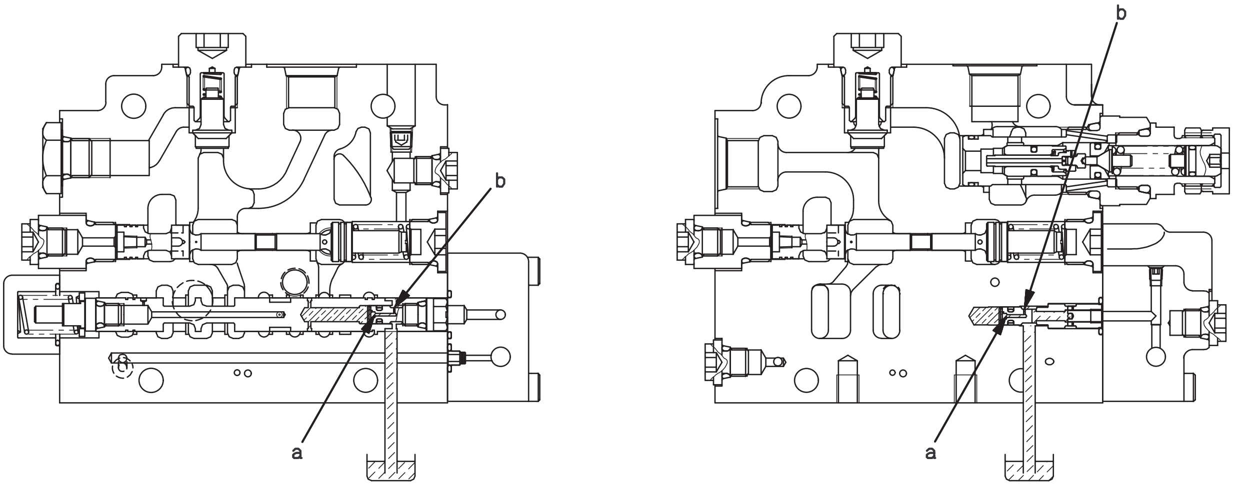
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

1. LS bypass plug
2. Valve cover

FUNCTION
- This releases the residual pressure of LS pressure **PLS**.
- It makes the speed of the rise in pressure of LS pressure **PLS** more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.

OPERATION
- The pressurized oil for LS circuit **PLS** passes from clearance filter **a** (formed by the clearance between LS bypass plug (1) and the valve cover (2)) through orifice **b** and flows to the tank circuit **T**.

PC35MR, 40MR, 50MR-2



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FUNCTION

- This releases the residual pressure of LS pressure.
- It makes the speed of the rise in pressure of LS pressure more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.

OPERATION

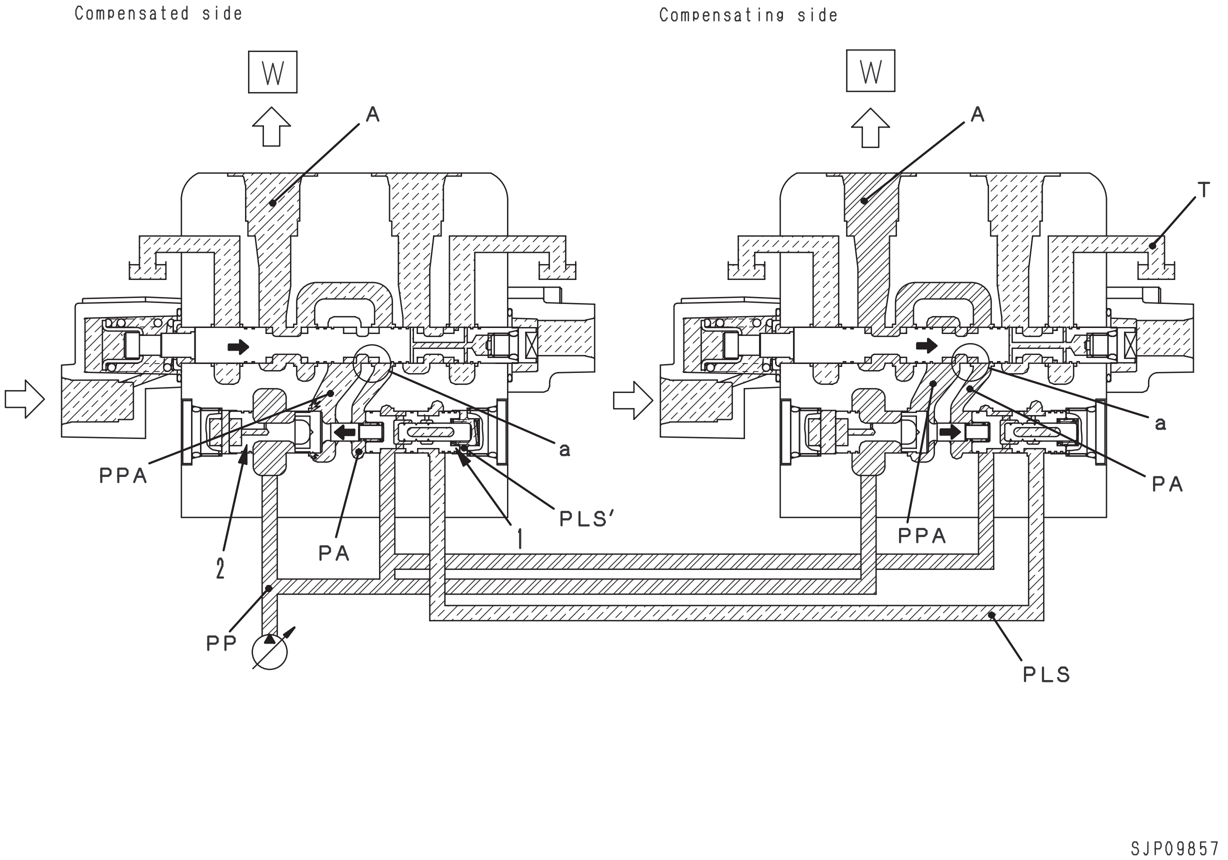
- The oil in LS circuit **PLS** flows through filter **a** and orifice **b** to the tank circuit.

PRESSURE COMPENSATION VALVE

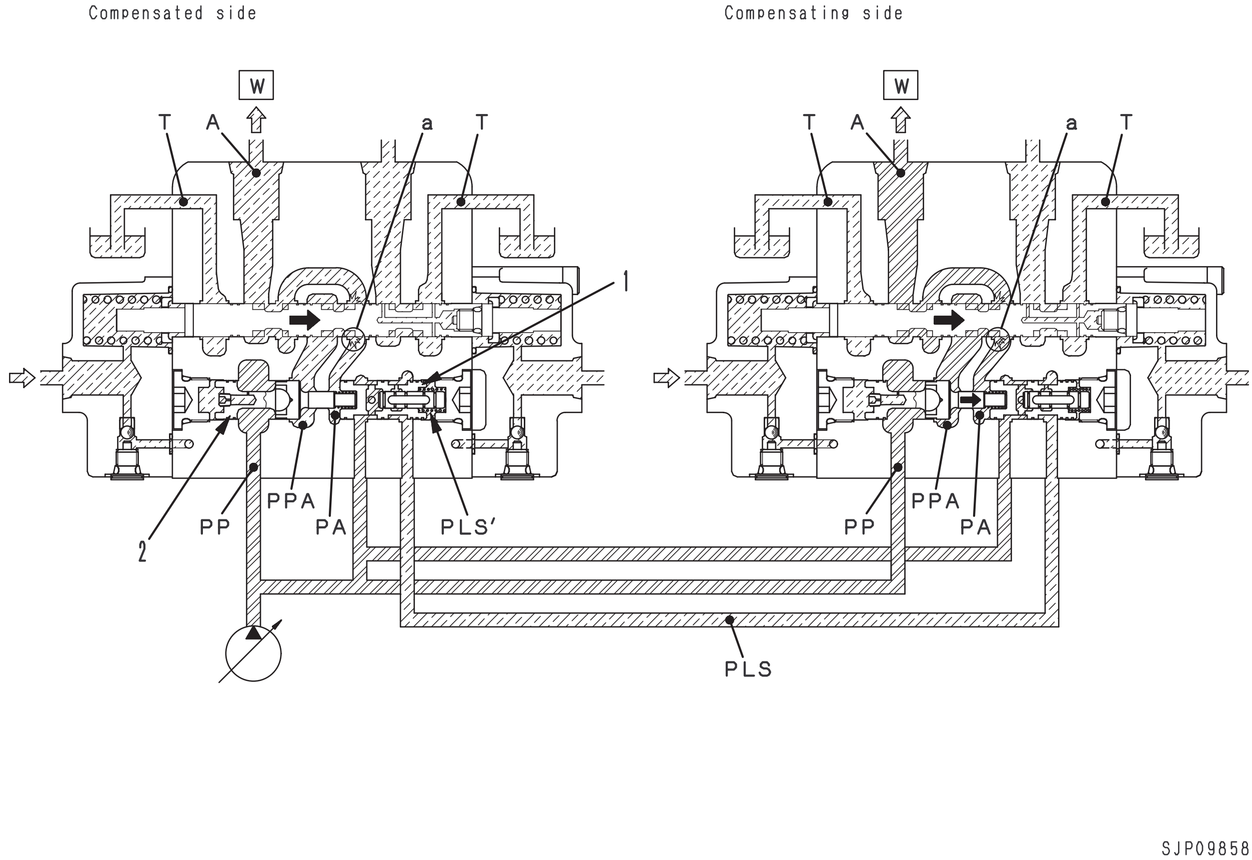
FUNCTION

- During compound operations, if the load pressure becomes lower than the other actuator and the oil flow tries to increase, compensation is received.
  (When this happens, the other actuator being used for compound operation (right side) is at a higher load than the actuator on this side (left side).)

PC30MR-2



PC35MR, 40MR, 50MR-2



OPERATION

- If the load pressure of the other actuator (right side) becomes higher during compound operations, the oil flow in actuator circuit **A** on this side (left side) tries to increase.
- If this happens, the LS pressure **PLS** of the other actuator acts on spring chamber **PLS'**, and reducing valve (1) and flow control valve (2) are pushed to the left.
- Flow control valve (2) throttles the area of opening between pump circuit **PP** and spool upstream **PPA**, and pressure loss is generated between PP and **PPA**.
- Flow control valve (2) and reducing valve (1) are balanced in position where the difference in pressure between **PLS** and **PA** acting on both ends of reducing valve (1) and the pressure loss between **PP** and **PPA** on both sides of flow control valve (2) are the same.
- In this way, the pressure difference between upstream pressure **PPA** and downstream pressure **PA** of both spools used during compound operations is the same, so the pump flow is divided in proportion to the area of opening of notch **a** of each spool.

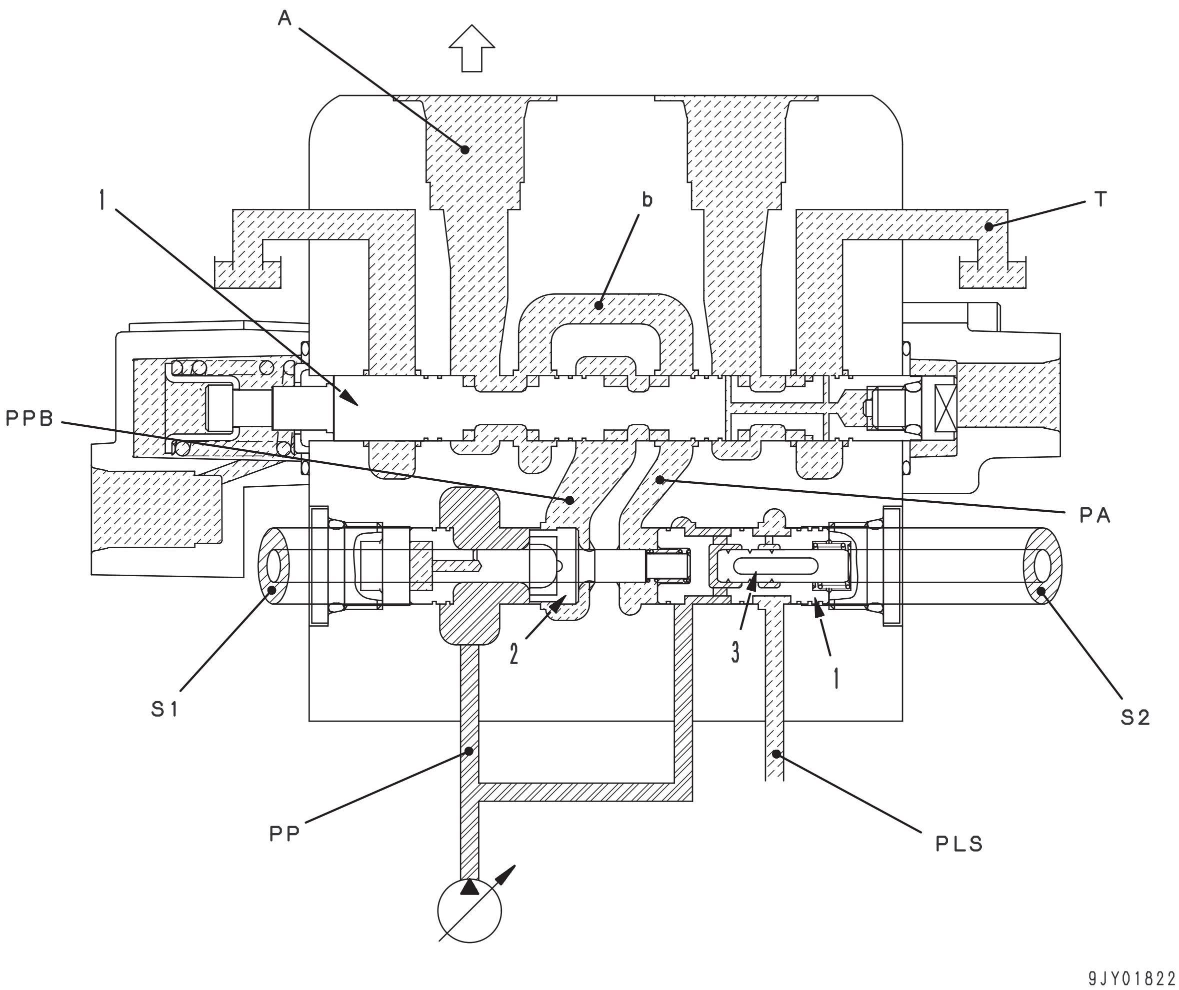
1. Area ratio of pressure compensation valve

FUNCTION

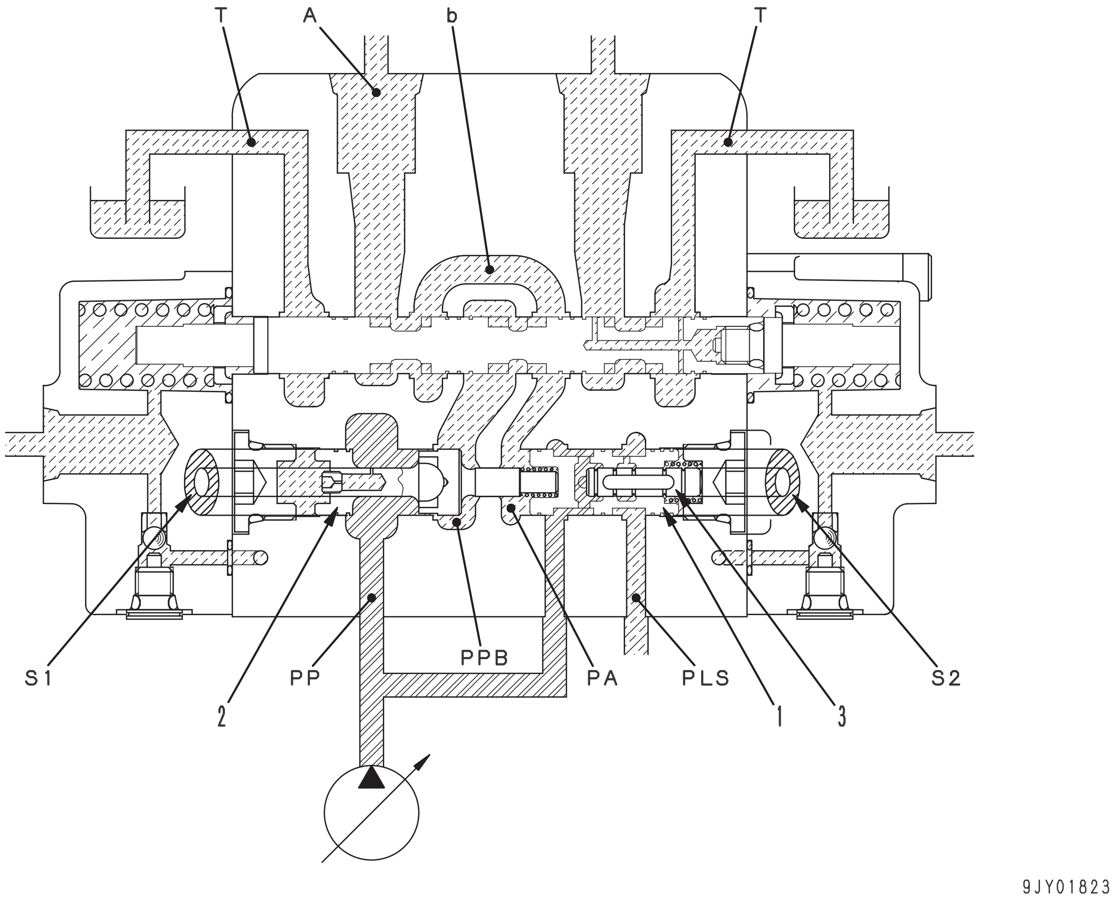
- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (**S2**/**S1**) between area **S2** of reducing valve (1) and area **S1** of flow control valve (2) to match the characteristics of each actuator.

S1: Area of flow control valve (2) - area of piston (3)
S2: Area of reducing valve (1) - area of piston (3)

PC30MR-2



PC35MR, 40MR, 50MR-2



Area ratio (S2:S1) and compensation characteristics

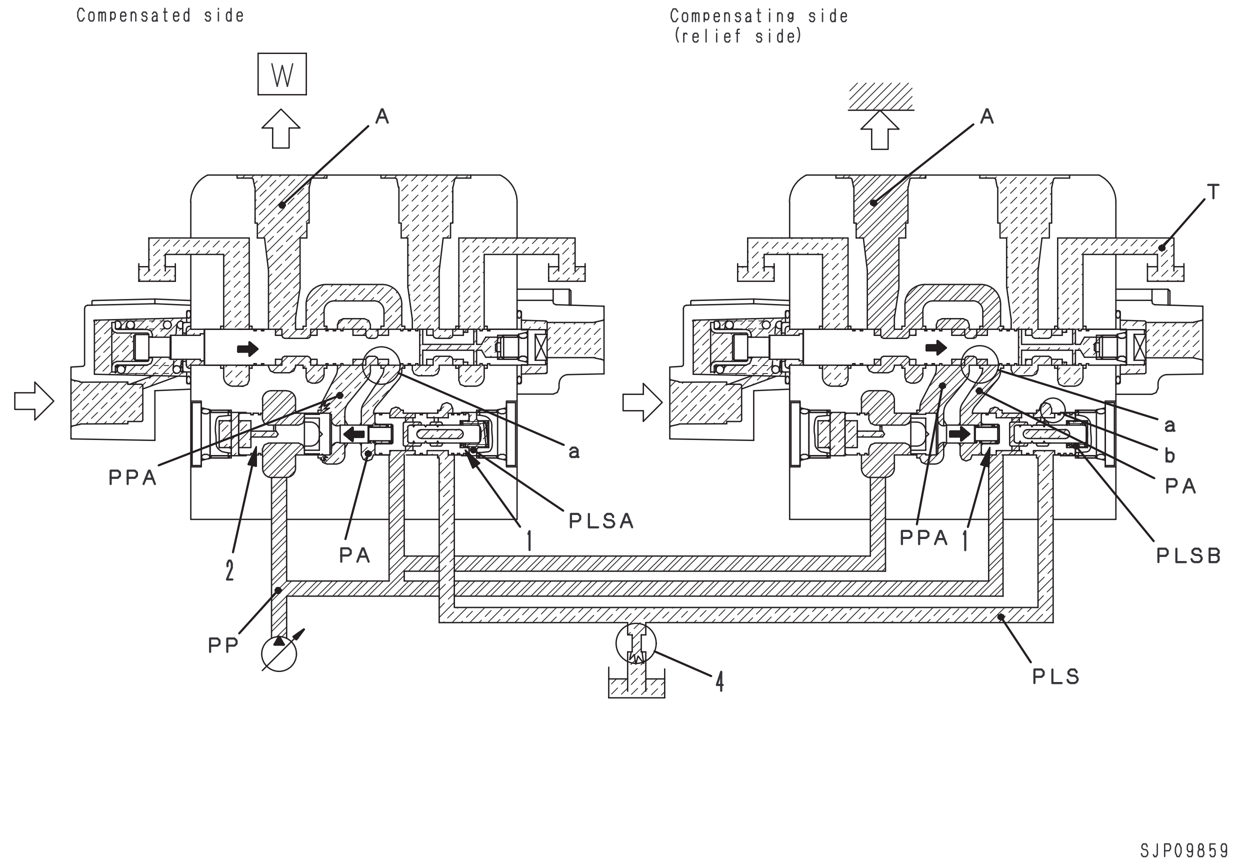
- When ratio is 1.00:
  [pump pressure **PP** – spool notch upstream pressure **PPB**] ≒ [LS circuit pressure **PLS** – actuator circuit pressure **PA** (= **A**)] and oil flow is divided in proportion to area of opening of spool.
- When ratio is more than 1.00:
  PP – **PPB** > **PLS** – **PA** (= **A**) and oil flow is divided in a proportion less than area of opening of spool.
- When ratio is less than 1.00:
  PP – **PPB** < **PLS** – **PA** (= **A**) and oil flow is divided in a proportion more than area of opening of spool.

2. LS receiving throttle of pressure compensation valve

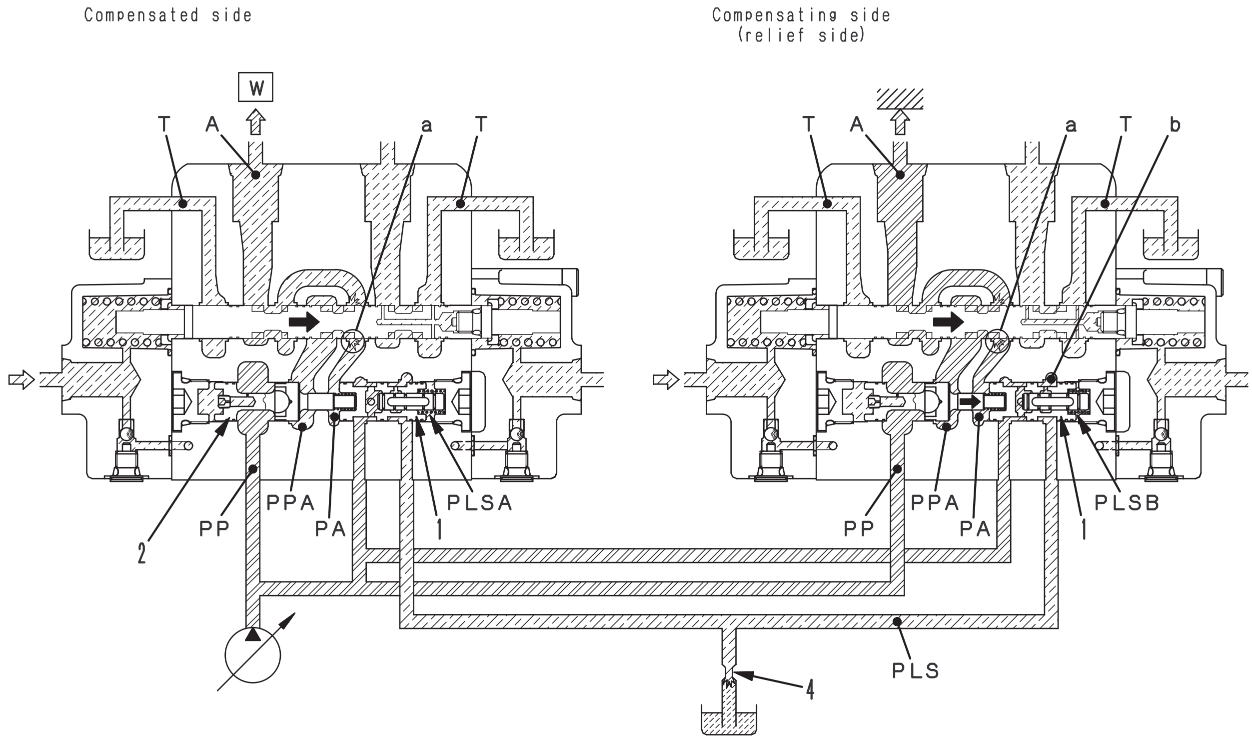
FUNCTION

- If the other actuator is relieved during compound operations, LS introduction throttle **b** of reducing valve (1) divides the flow and sends more oil to the side receiving compensation.

PC30MR-2



PC35MR, 40MR, 50MR-2



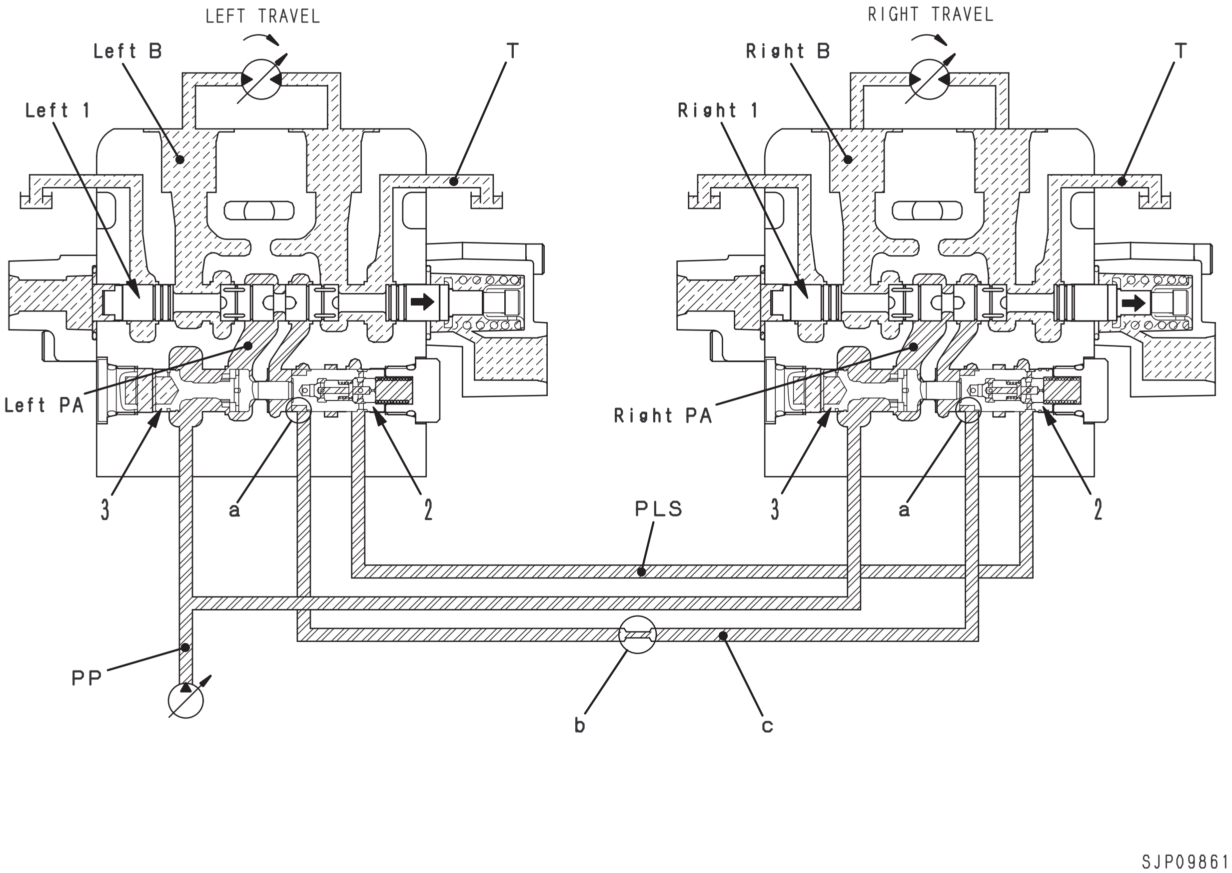
OPERATION

- If the other actuator (right side) is relieved during compound operations, each circuit pressure (**PPA**, **PA**) of the other actuator becomes the same as the pump circuit pressure (**PP** = relief pressure).
- In this case, spring chamber **PLS2** of the other actuator becomes the same as pump circuit pressure **PP** because of the balance of reducing valve (1).
- **PLS2** passes through LS introduction throttle b of reducing valve (1) and becomes **PLS**. **PLS** is connected to the tank circuit **T** from LS bypass plug (4), so pressure loss is generated at LS introduction throttle **b** (the condition becomes **PLS**<**PLS2**).
- As a result, even if the other actuator is relieved, a pressure differential is created between **PP** and **PLS**, so more oil flows to actuator circuit **A** on this side (left side).

L.H., R.H. TRAVEL JUNCTION CIRCUIT

PC27MR, 30MR-2

1. When traveling in a straight line



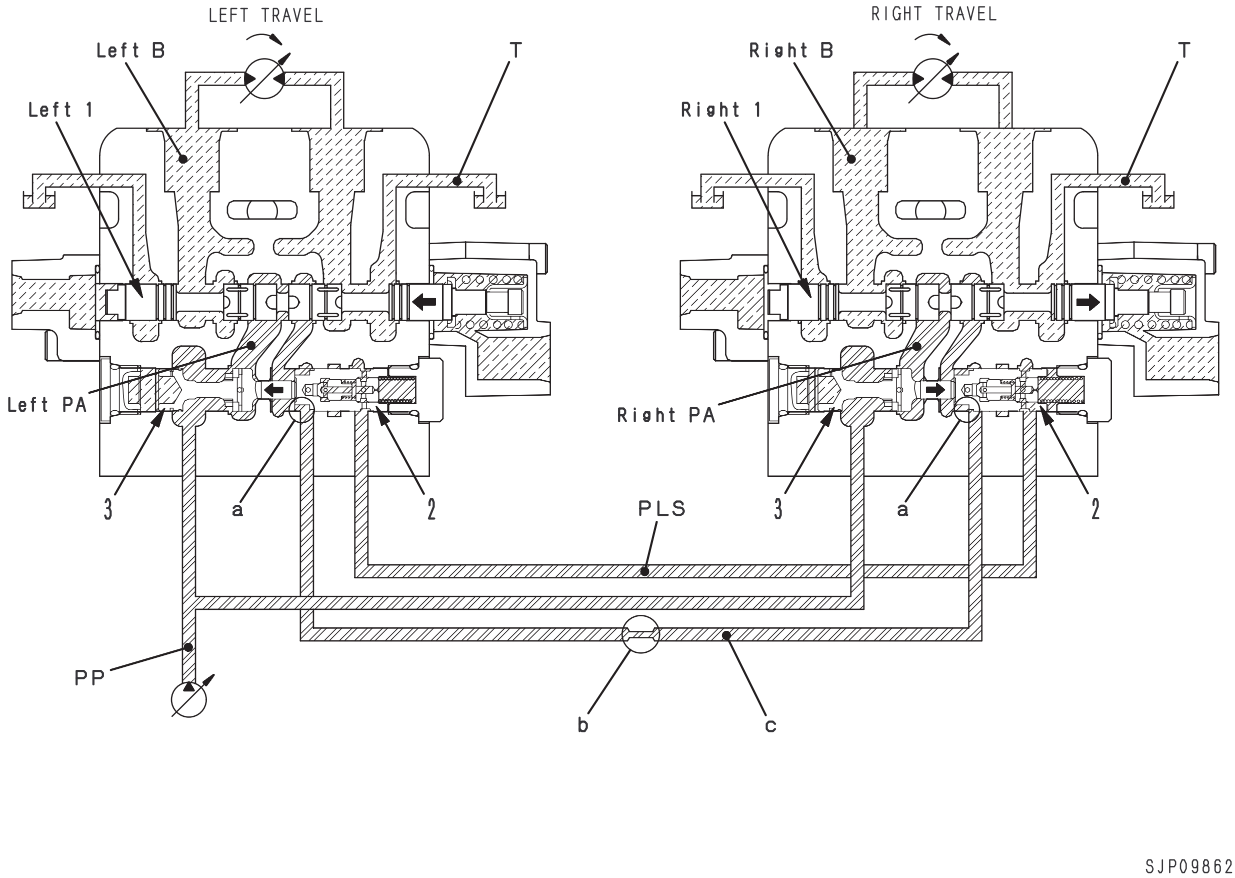
FUNCTION

- To compensate for any difference in the oil flow in the left and right travel circuits when traveling in a straight line, the junction circuit opens when the left and right travel spools are operated.
- In this way, the flow of oil to the left and right travel motors is almost the same when traveling in a straight line, so there is no travel deviation.
- When steering the machine, the difference in the load pressure returns the reducing valve of the travel valve on the inside of the turn and the opening of the notch in the travel junction valve spool becomes smaller, so the machine can be steered.

OPERATION

- When left and right travel spools (1) are operated, the pump discharge flows from pump circuit **PP** and circuits **PA** to actuator circuits **B**.
- When traveling in a straight line, to make actuator circuits **PA** equal, left and right reducing valves (2) are pushed to the right by the same amount, and notch **a** and the travel junction circuit are opened.
- In this way, the left and right travel actuator circuits are interconnected by the travel junction circuit, so if any difference occurs in the flow of oil to the left and right travel motors, the compensation is carried out to prevent any deviation in travel.

2. Steering when traveling

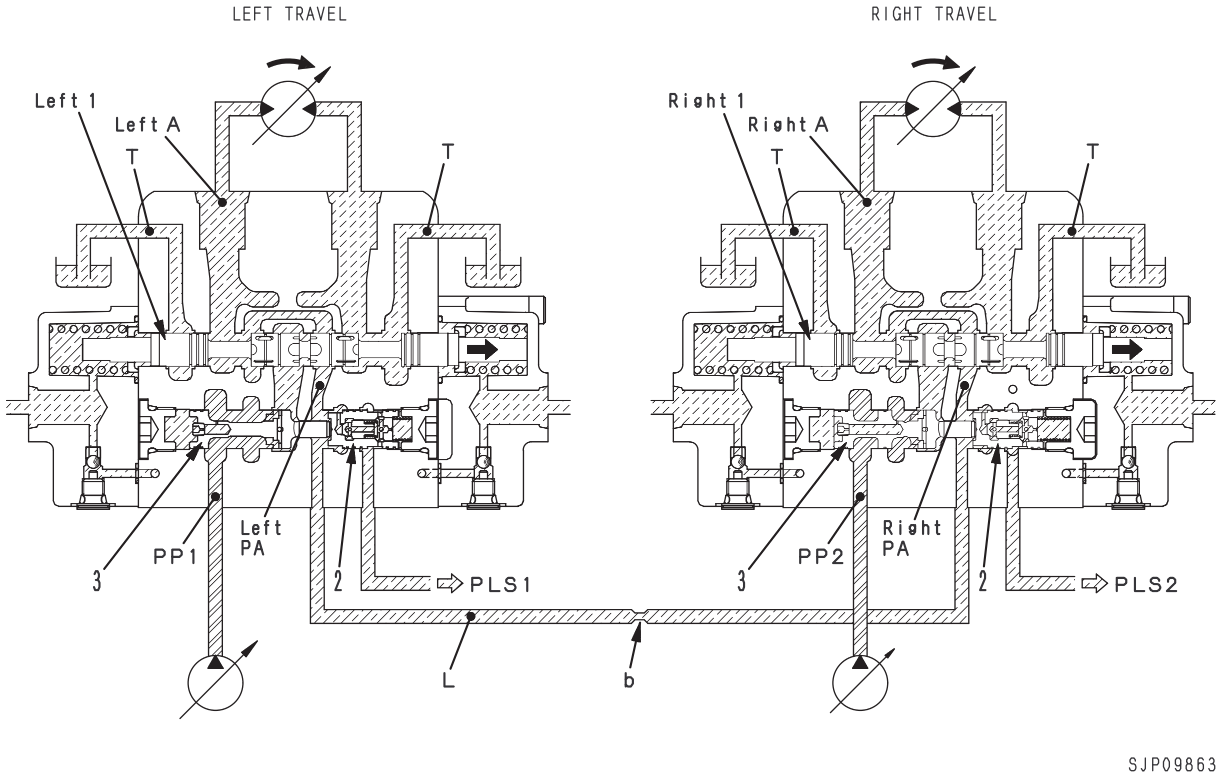


OPERATION

- When traveling in a straight line, if left travel spool (**L. H. 1**) is returned to the neutral position and the steering is operated, a difference (**R. H. B** > **L. H. B**) is generated in the load pressure of left and right travel actuator circuits **PA**, and LS pressure **PLS** becomes the same pressure as **R. H. B**.
- As a result, flow control valve (3) on the left travel side is pushed to the left by LS circuit **PLS**. Because of this, the opening of the left notch **a** is made smaller, so it becomes possible to operate the steering when traveling.
- Damper **b** is provided in the circuit to damper any excessive characteristics in the opening or closing of the travel junction circuit if the spool is operated suddenly.

PC35MR, 40MR, 50MR-2

1. During straight travel



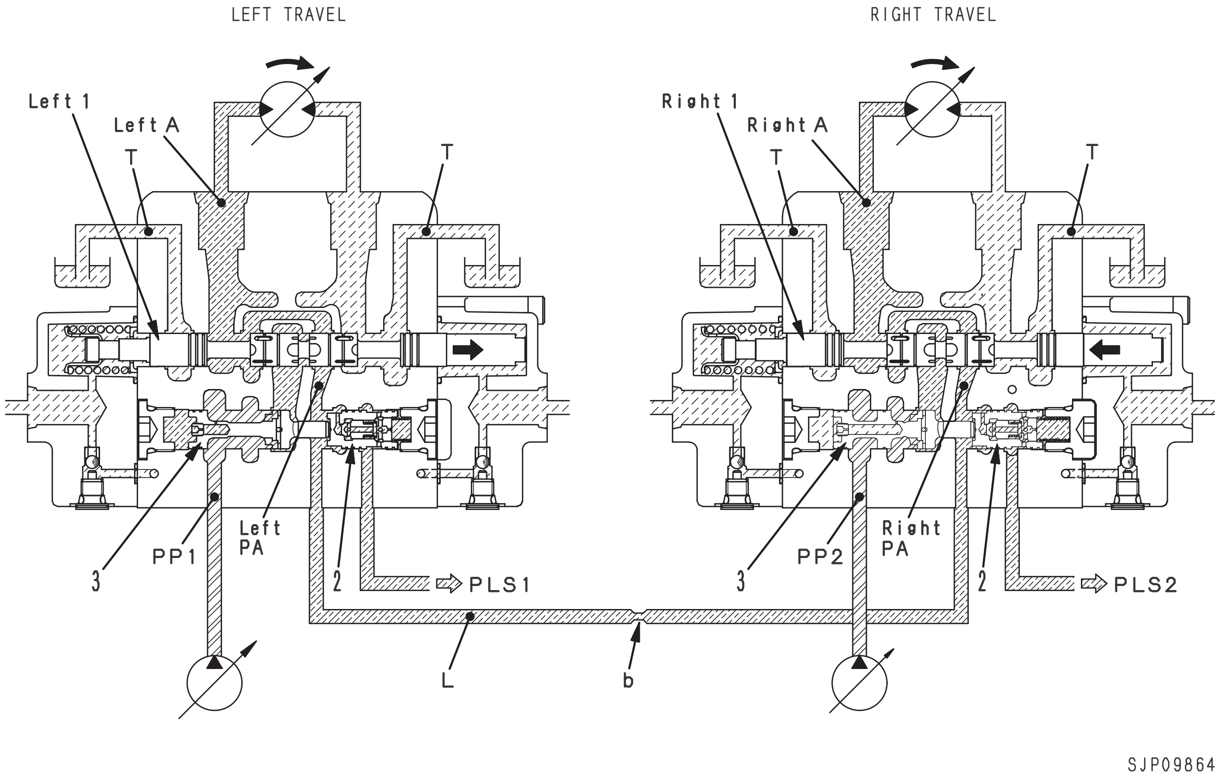
FUNCTION

- An interconnection circuit is installed to correct the flow error in both travel circuits during straight travel.
- With this circuit, the flow rates in both travel motors become almost the same during straight travel to reduce travel deviation.
- Dampers b are installed to ease the transient characteristics of sudden opening and closing of the interconnection circuit when the machine is steered and the spools are operated sharply.

OPERATION

- Bridge circuits **PA** of both travel circuits are connected to each other by interconnection circuit **L**. Accordingly, if there is difference between the oil flow rates in both travel motors, it is corrected to reduce the travel deviation.

2. Steering when traveling



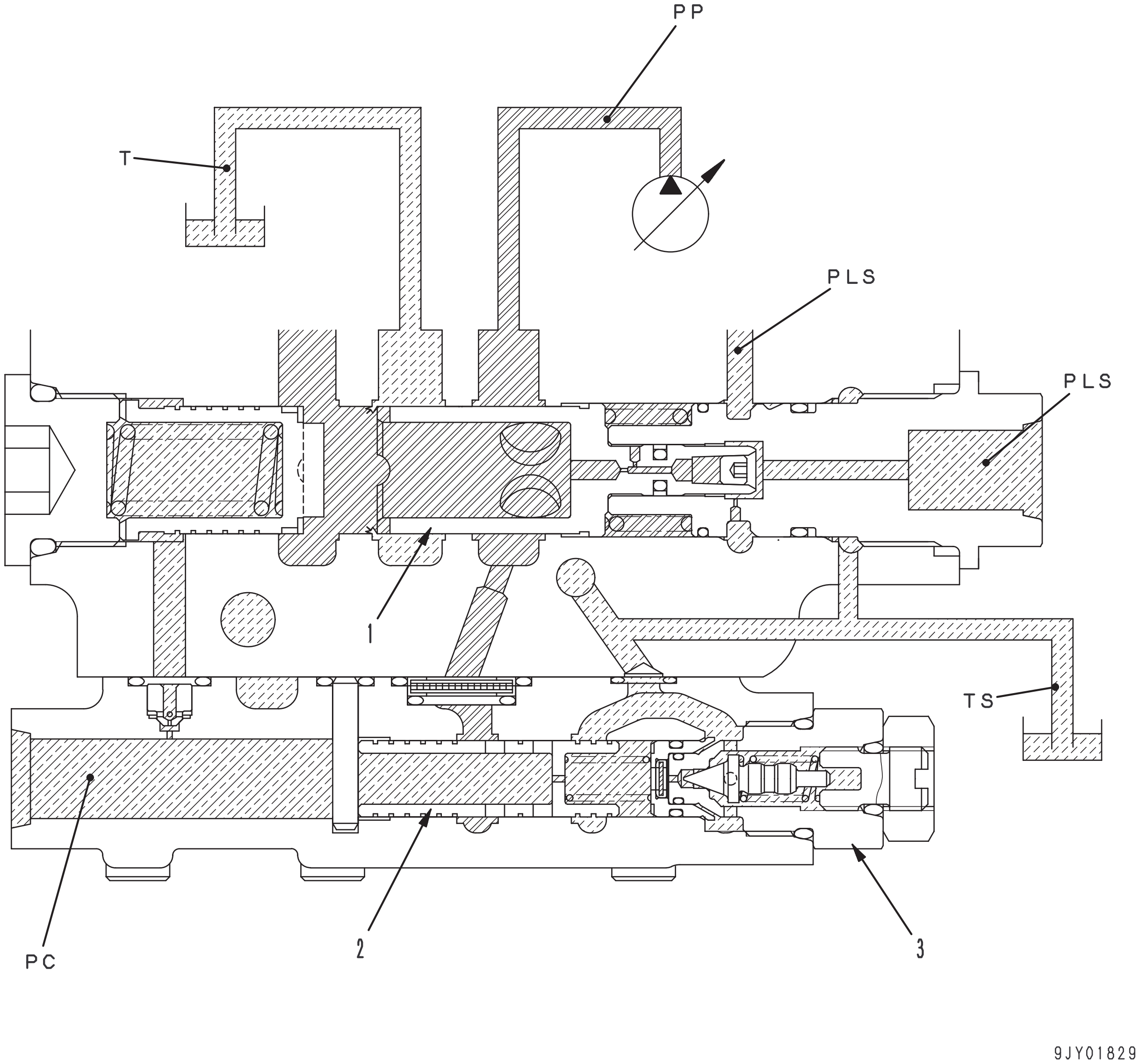
OPERATION

- When the right travel spool (**R. H. 1**) is returned to the neutral position to steer the machine in the straight travel state, the load pressures in both travel actuator circuits **PA** become different (**L. H. A** > **R. H. A**).
- Since the main pump is separated at this time, oil flows in both travel motors according to the opening area of the spool.

SELF-PRESSURE REDUCING VALVE

PC27MR, 30MR-2

1. When the control valve is held



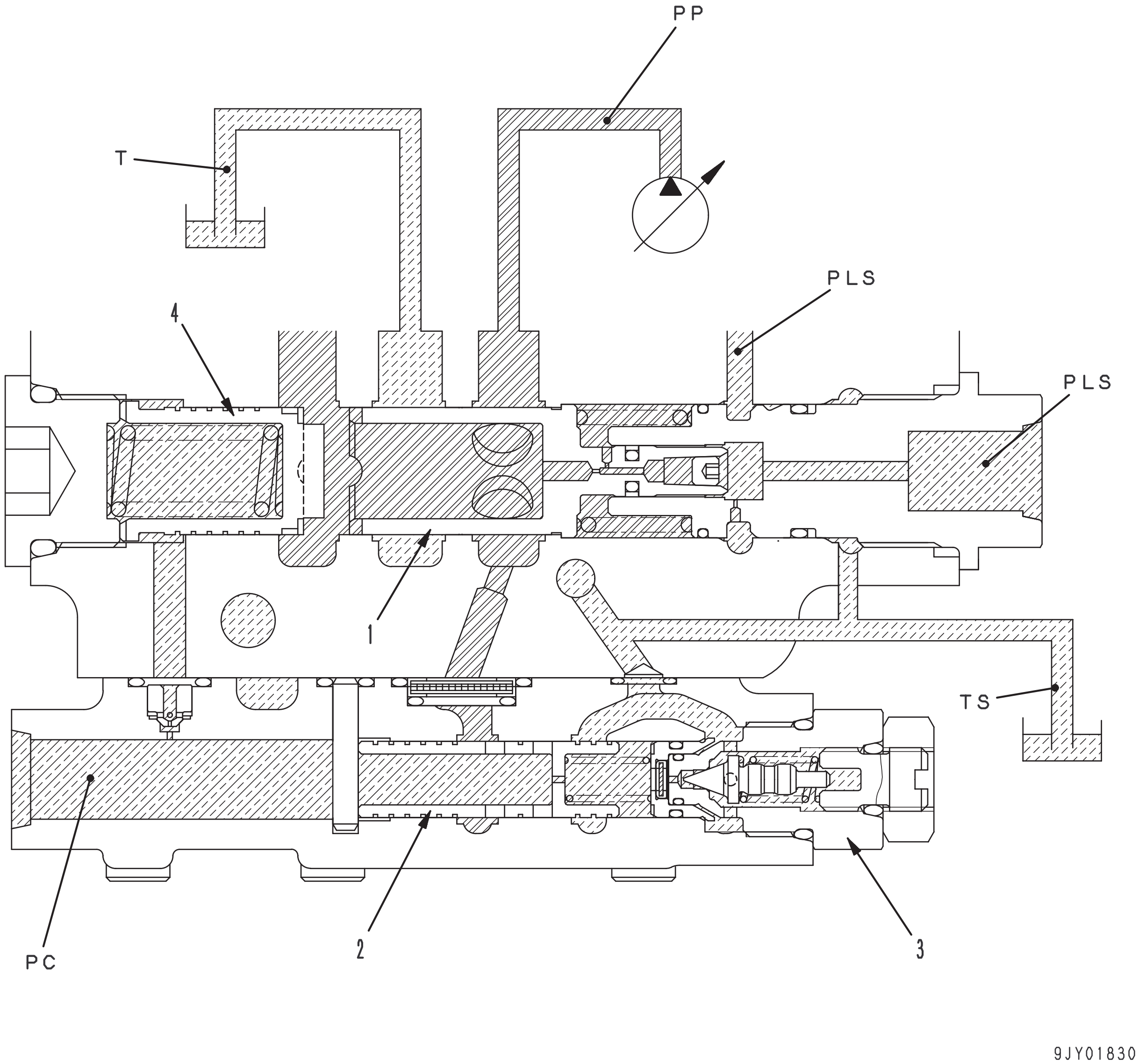
FUNCTION

- This valve reduces pump discharge pressure **PP** and supplies the pilot main pressure of 2.90 MPa {30.0 kg/cm^2} to the PPC valve.
- When the actuator circuit pressure is low, the self-pressure sequence valve is closed to raise pump discharge pressure **PP** to secure the pilot main pressure.

OPERATION

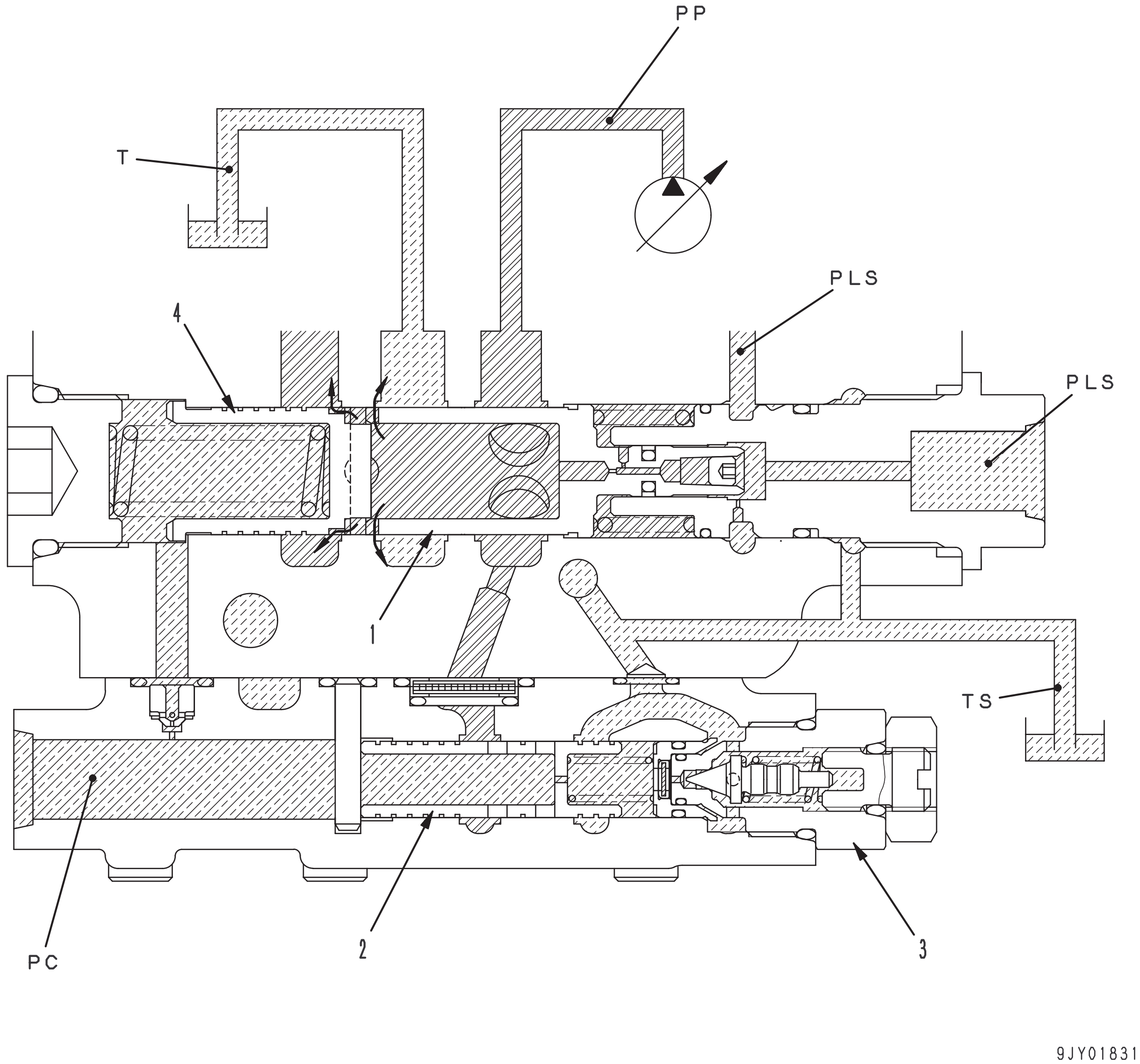
- Unload spool (1) moves and pump discharge pressure **PP** is set to 2.90 MPa {30.0 kg/cm^2}. (See the explanation of the unload valve.)
- Pump discharge pressure **PP** is reduced to 2.90 MPa {30.0 kg/cm^2} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3), and the main pressure oil is supplied through the **PC** port to the PPC valve.

2. When the control valve is operated



OPERATION

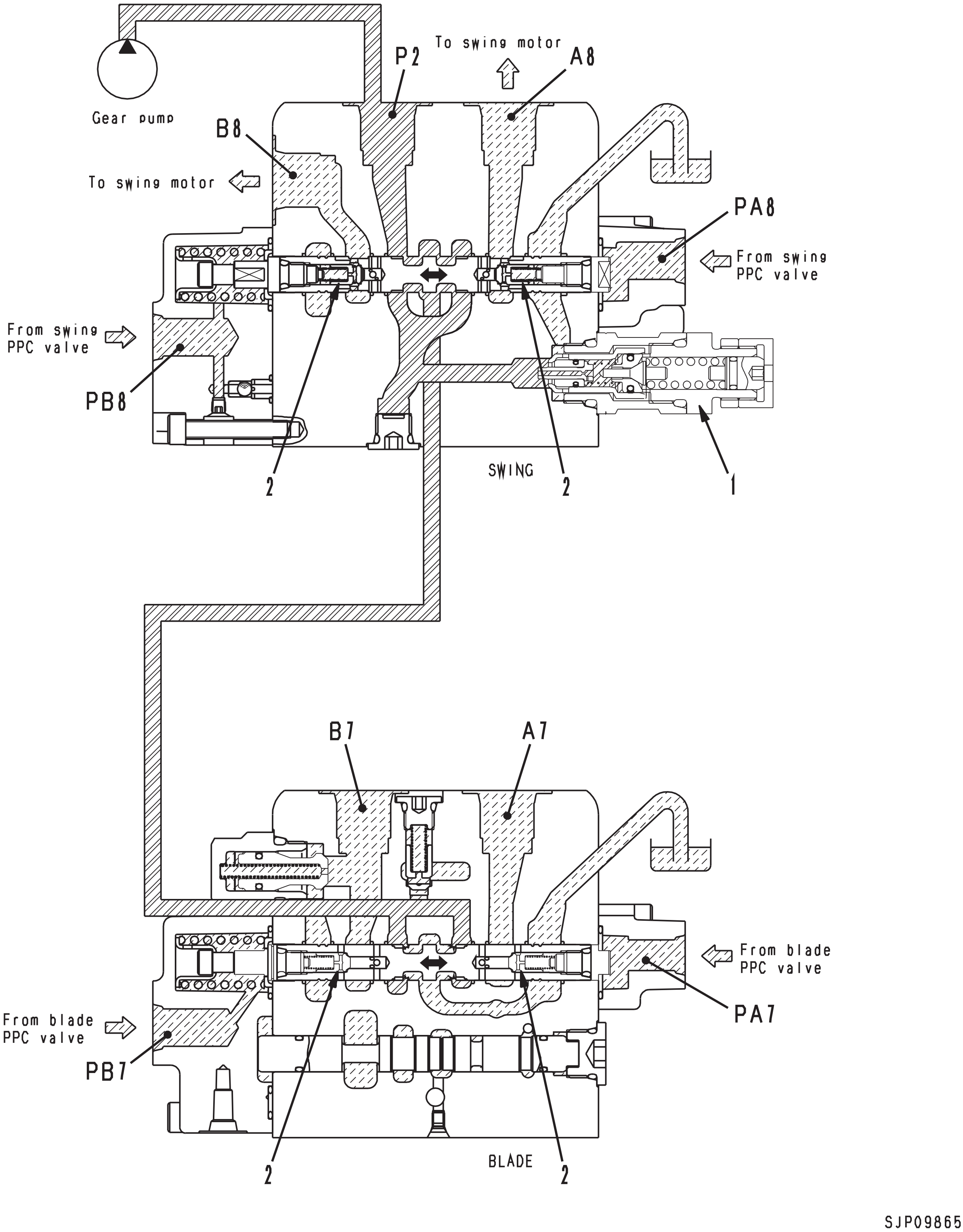
- Unload spool (1) moves to the left and pump discharge pressure **PP** becomes higher than the LS pressure by the LS differential pressure. (See the explanation of unload valve.)
- When pump discharge pressure **PP** is higher than 2.90 MPa {30.0 kg/cm^2}, it is reduced to 2.90 MPa {30.0 kg/cm^2} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3), and the pressure oil is supplied through the **PC** port to the PPC valve.
- At this time, self-presser sequence valve (4) is kept open.



OPERATION

- When pump discharge pressure **PP** is below 2.90 MPa {30.0 kg/cm^2}, self-pressure sequence valve (4) moves to the right to reduce the opening area between **PP** and actuator circuit (5).
- As a result, differential pressure is made between **PP** and actuator circuit (5) and **PP** is raised to above 2.90 MPa {30.0 kg/cm^2}, then it is reduced to 2.90 MPa {30.0 kg/cm^2} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3), and the pressure oil is supplied through the **PC** port to the PPC valve.

SWING AND BLADE VALVE
PC27MR, 30MR-2



STRUCTURE

- The swing and blade sections are the open center valves of the gear pump. They are arranged tandem, with the swing section ahead of the blade section.

OPERATION

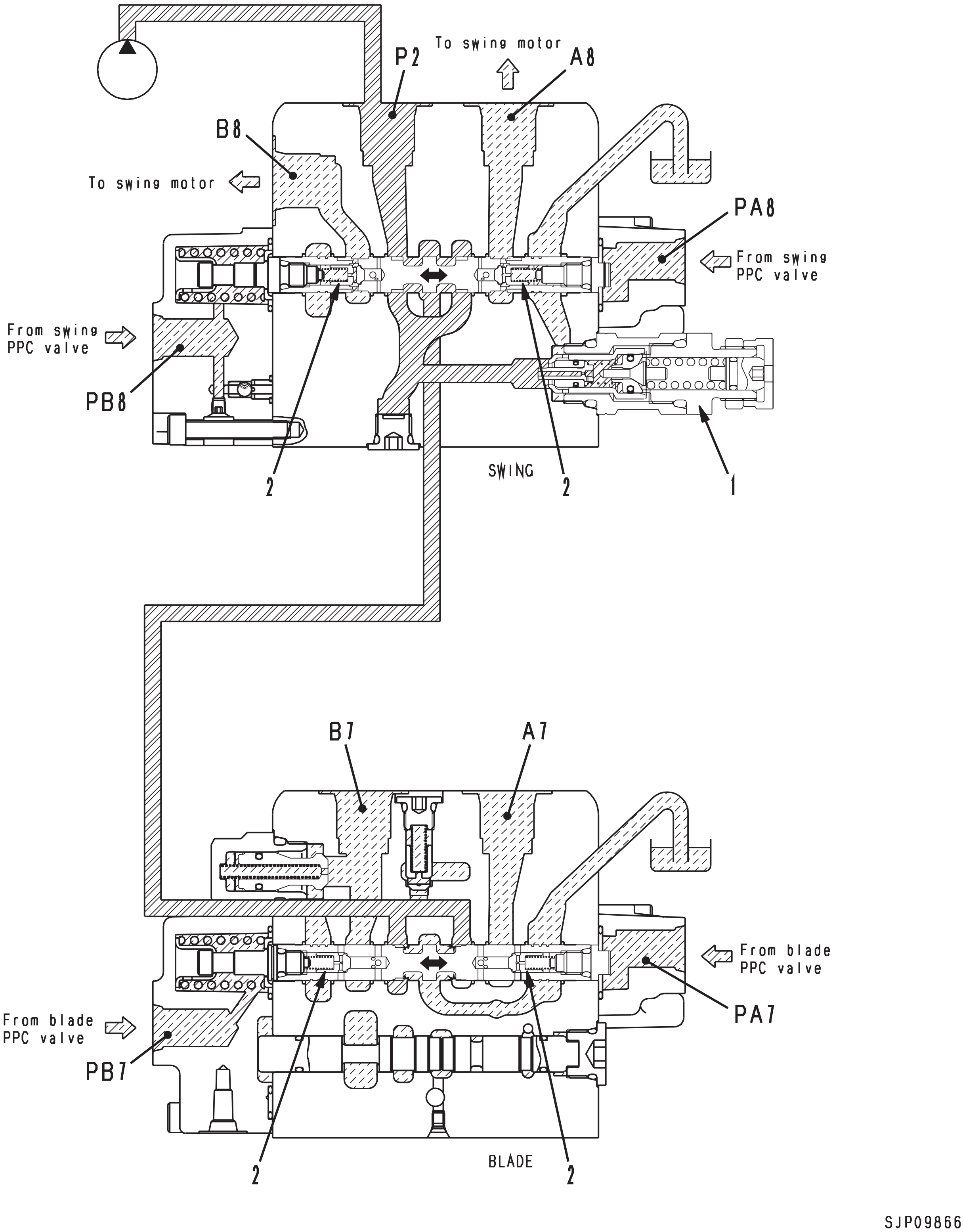
Swing section

- If pressure is applied from the PPC valve to the **PA8** port, the spool moves to the left and oil flows in the **A8** port.
- If pressure is applied from the PPC valve to the **PB8** port, the spool moves to the right and oil flows in the **B8** port.
- Load check valve (2) is installed in each spool, corresponding to ports **A** and **B** of each valve.
- Relief valve (1) for the gear pump is installed to the swing section.

Blade section

- If pressure is applied from the PPC valve to the **PA7** port, the spool moves to the left and oil flows in the **A7** port.
- If pressure is applied from the PPC valve to the **PB7** port, the spool moves to the right and oil flows in the **B7** port.
- Load check valve (2) is installed in each spool, corresponding to ports **A** and **B** of each valve.

PC35MR, 40MR, 50MR-2



STRUCTURE

- The swing and blade sections are the open center valves of the gear pump. They are arranged tandem, with the swing section ahead of the blade section.

OPERATION

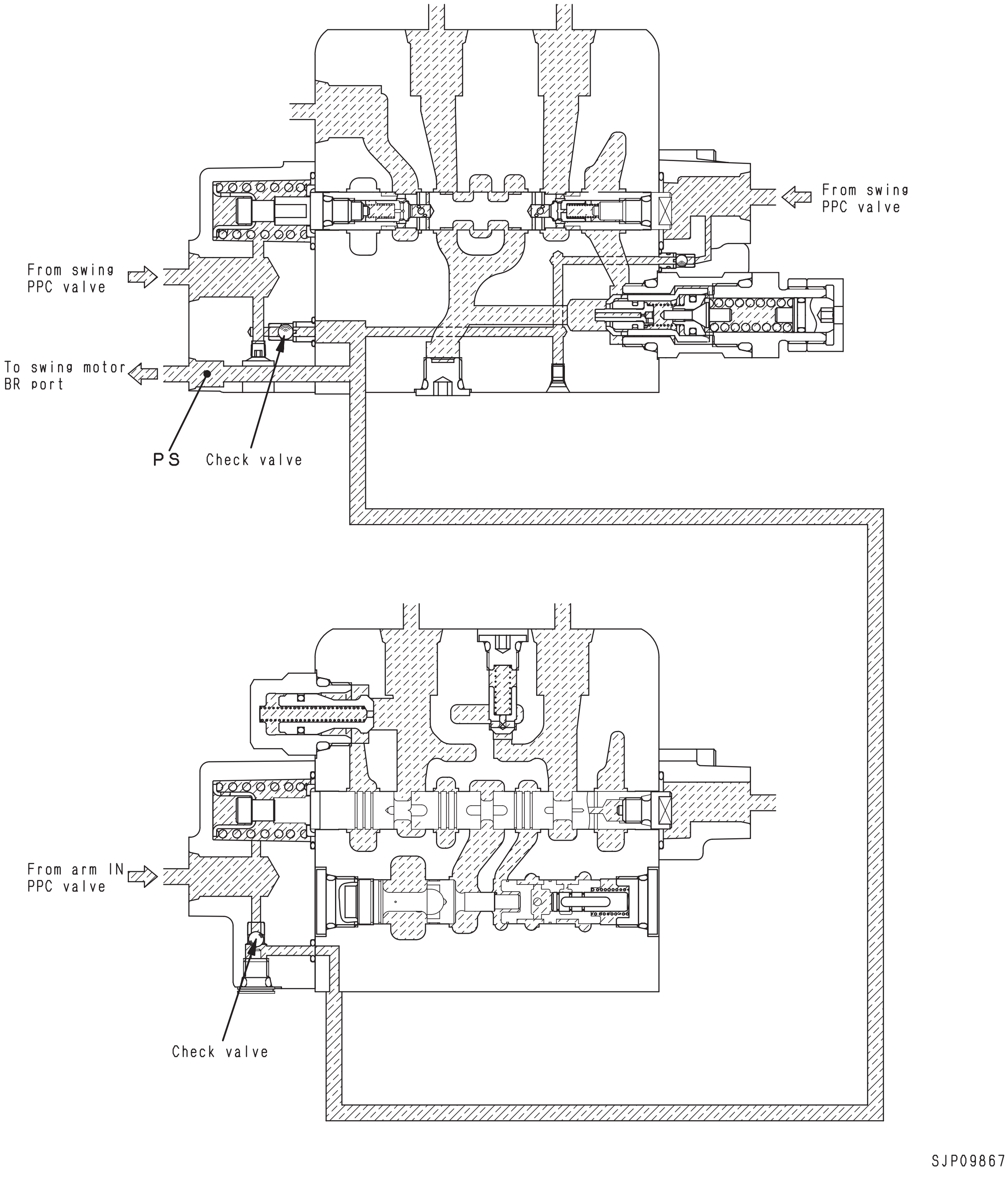
Swing section

- If pressure is applied from the PPC valve to the **PA8** port, the spool moves to the left and oil flows in the **A8** port.
- If pressure is applied from the PPC valve to the **PB8** port, the spool moves to the right and oil flows in the **B8** port.
- Load check valve (2) is installed in each spool, corresponding to ports **A** and **B** of each valve.
- Relief valve (1) for the gear pump is installed to the swing section.

Blade section

- If pressure is applied from the PPC valve to the **PA7** port, the spool moves to the left and oil flows in the **A7** port.
- If pressure is applied from the PPC valve to the **PB7** port, the spool moves to the right and oil flows in the **B7** port.
- Load check valve (2) is installed in each spool, corresponding to ports **A** and **B** of each valve.

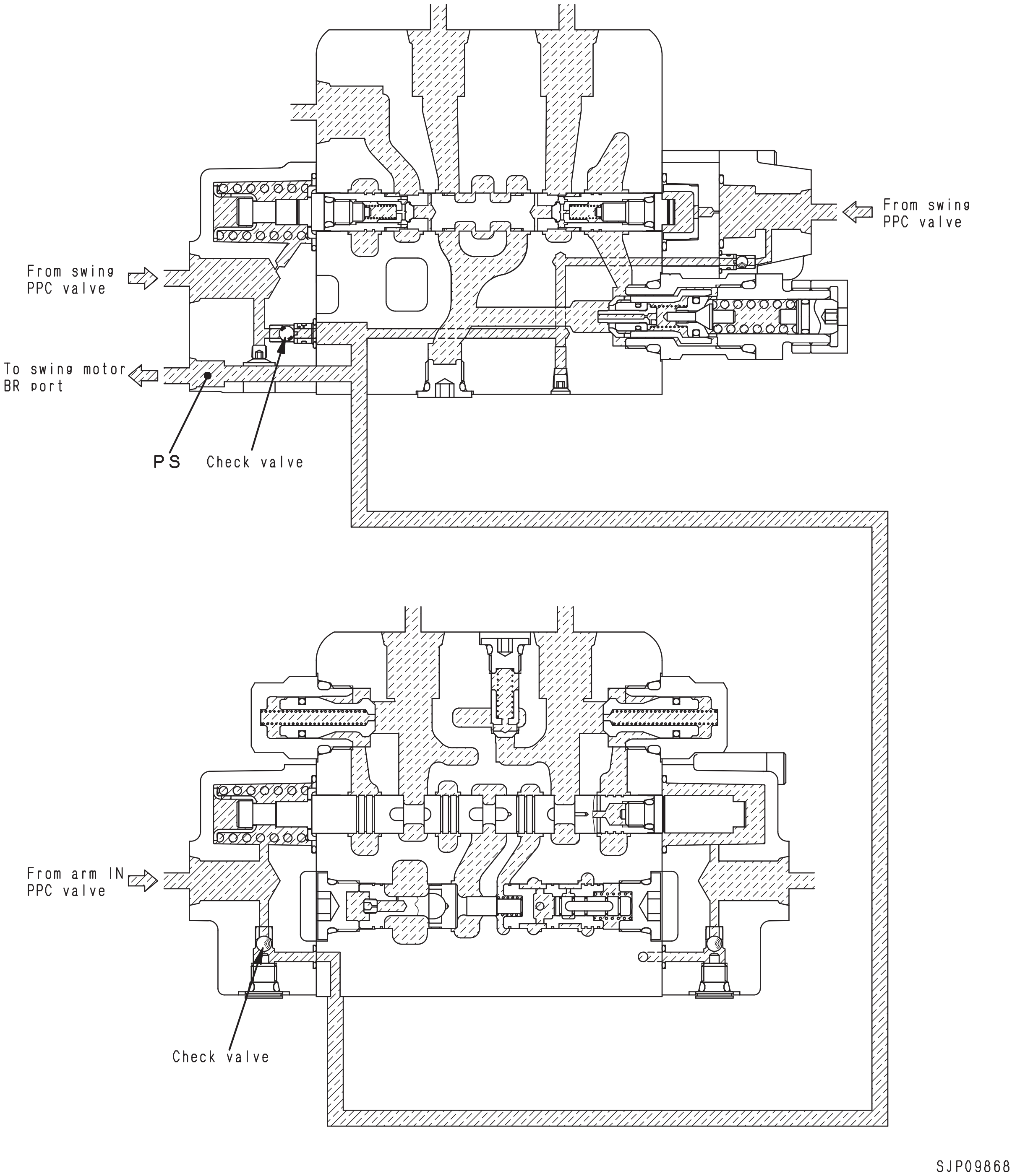
SWING HOLDING BRAKE CANCEL SYSTEM
PC27MR, 30MR-2



FUNCTION

- This system resets the swing holding brake by using both swing PPC pressures and arm IN PPC pressure as signals.

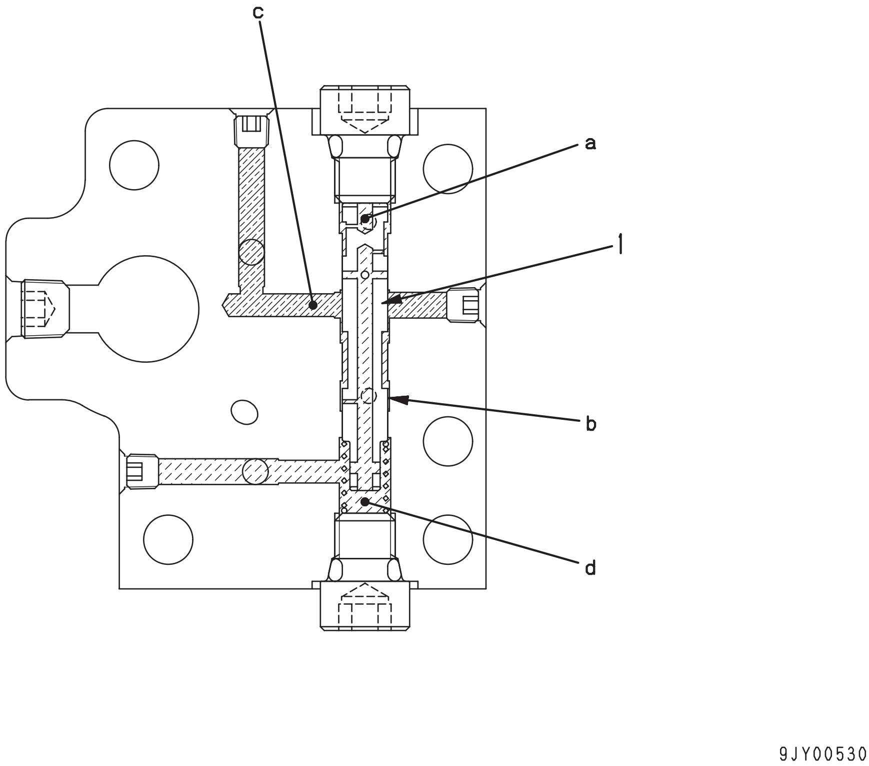
PC35MR, 40MR, 50MR-2



OPERATION

- The left and right swing PPC pressure and the arm IN PPC pressure each pass through check valve inside spring case, are output to port **BR** from **PS** port, and the swing holding brake is canceled. (The highest pressure is output to port **BR**.)
- The arm and swing are connected by the pilot circuit inside the control valve.

LOGIC VALVE
PC35MR, 40MR, 50MR-2



FUNCTION
- This valve changes the pilot pressure to change the merge-divider valve.

OPERATION

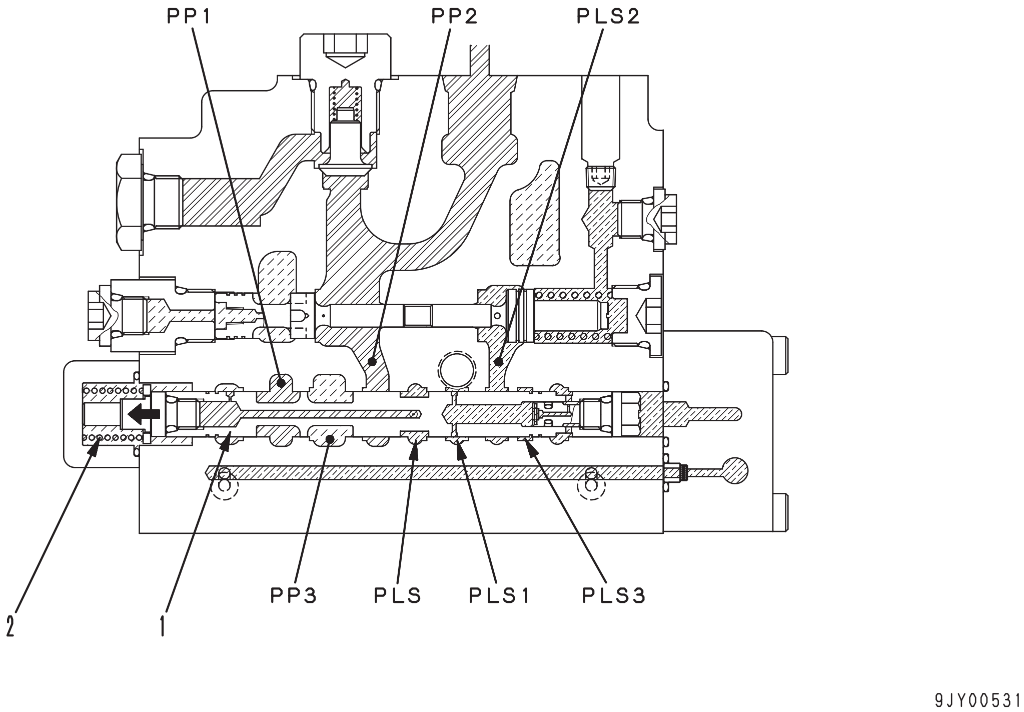
1. When divided
- If only the travel PPC pressure is applied to port **b**, it is applied to output port **c** of the pump merge-divider valve as it is. This pressure sets the pump merge-divider valve in the division mode.

2. When merged
- If the work equipment PPC pressure (excluding the swing pressure) is applied to port **a**, the pressure in output port **c** of the pump merge-divider valve is connected through spool (1) to spring chamber **d** and used as seal drain pressure.
- Accordingly, the pump merge-divider valve is not changed but kept in the merging mode. Even if the travel PPC pressure is applied under this condition, spool (1) is kept pressed and the valve is kept in the merging mode.

MERGE-DIVIDER VALVE

PC35MR, 40MR, 50MR-2

1. When machine travels singly



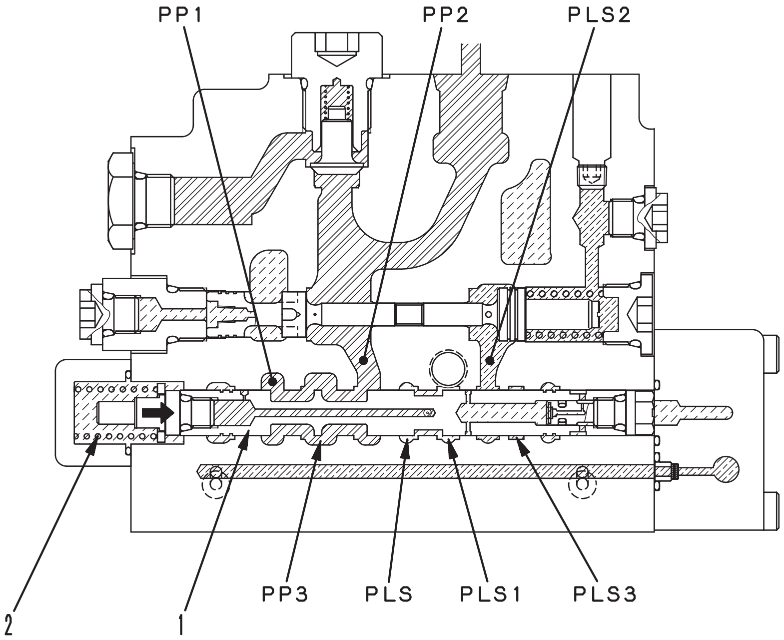
FUNCTION

- When the machine travels singly, the merge-divider valve spool separates pump pressures **PP1** and **PP2**.

OPERATION

- When the machine travels singly, the travel port pressure is applied through the logic valve spool to the right side of merge-divider valve spool (1). If this pressure exceeds the force of spring (2), merge-divider valve spool (1) is pushed to the right and left to separate pump pressures **PP1**, **PP2** and **PP3**.
- At this time, LS pressures **PLS1**, **PLS2** and **PLS3** are also separated from each other. The pump pressure is output to output pressure **PLS** applied to the pump LS valve.

2. When "work equipment is operated" and when "machine travels and work equipment is operated simultaneously"



9JY00532

FUNCTION

- When the work equipment is operated and when the machine travels and the work equipment is operated simultaneously, the merge-divider valve spool merges pump (discharge) pressures **PP1** and **PP2**.

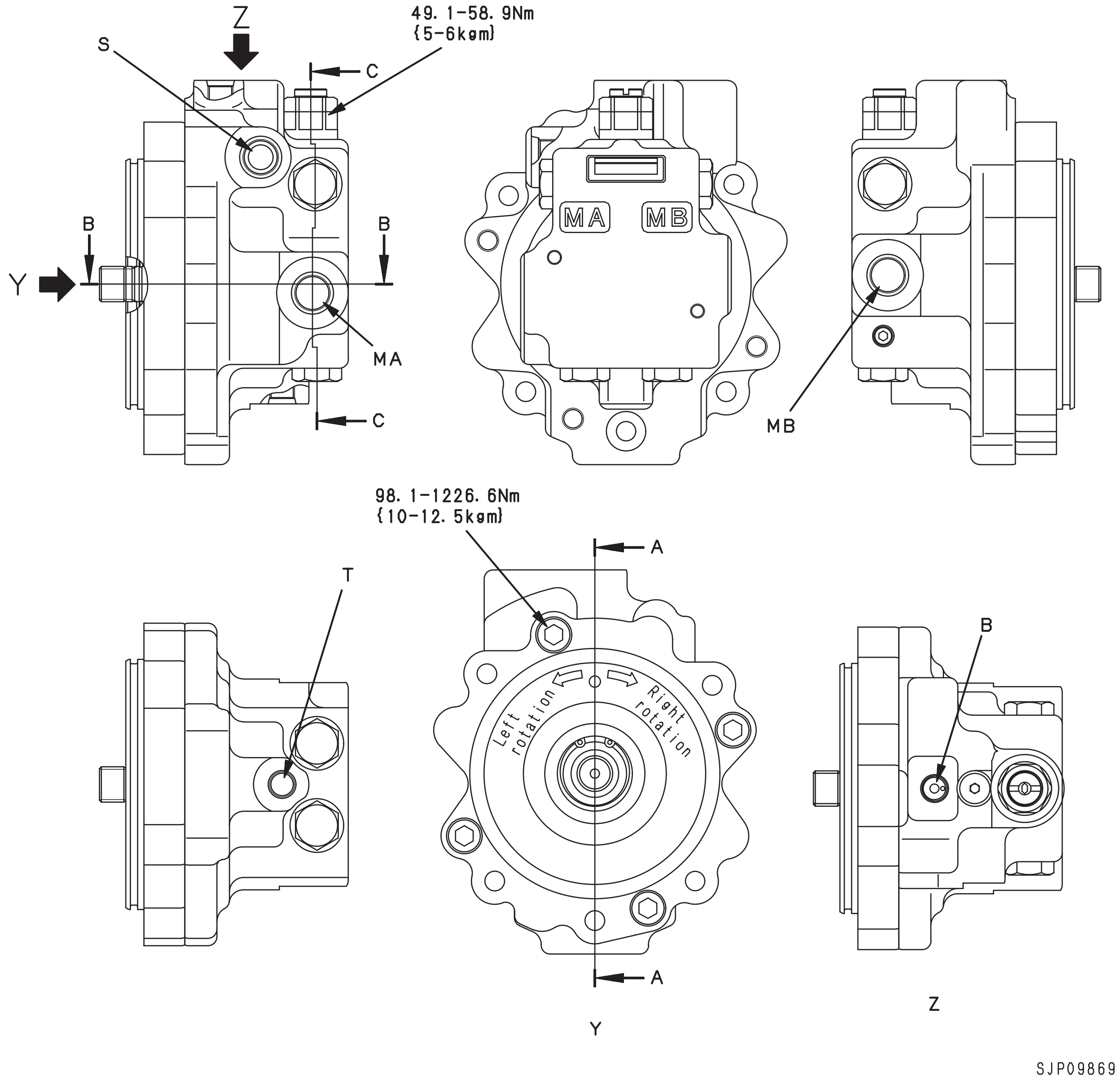
OPERATION

- When the work equipment is operated, the logic valve spool is changed by pump pressure **PP2** output by the throttle valve and the oil for changing the pump merge-divider valve is drained into the tank.
- Accordingly, pump merge-divider valve spool (1) is pressed to the right by the force of spring (2) and pump pressures **PP1**, **PP2** and **PP3** are merged. At this time, LS pressures **PLS1**, **PLS2** and **PLS3** are merged, too.
- When the machine travels and the work equipment is operated simultaneously, the travel port pressure is not applied to the pump merge-divider valve, since the logic valve spool is changed. Since the oil for changing the pump merge-divider valve is drained into the tank, the oils are merged.
- When the control lever is in neutral, the spring force of the pump merge-divider valve spool is larger because of the valve changing force made by the travel PPC pressure. Accordingly, the oils are merged.

SWING MOTOR

PC27MR, 30MR, 35MR-2

Type: LMF16

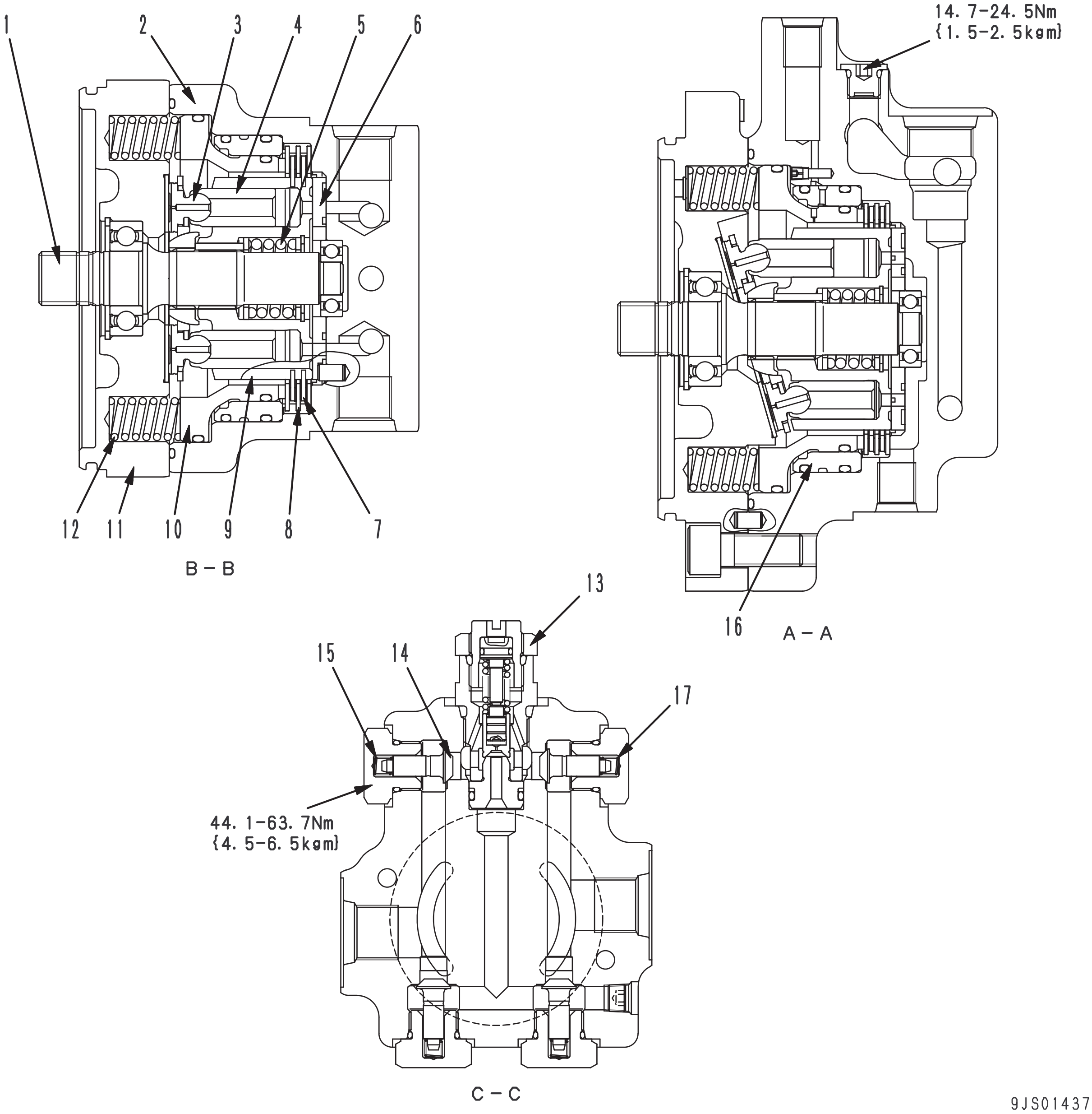


B : From control valve
S : From tank
T : To tank
MA : From control valve
MB : From control valve

SPECIFICATIONS

Model		PC27MR-2	PC30MR, 35MR-2
Type		LMF16	
Theoretical discharge	cc/rev	16.1	
Rated speed	rpm	1,160	1,114
Rated discharge amount	ℓ/min	19	18
Suction valve cracking pressure	MPa {kg/cm^2}	Max. 0.04 {0.45}	
Safety valve set pressure	MPa {kg/cm^2}	17.2 {175}	19.1 {195}

PC27MR-2


1
2
3
4
5
6
7
8
9
10
11
12
B – B
14. 7–24. 5Nm
{1. 5–2. 5kgm}
16
A – A
13
15
14
17
44. 1–63. 7Nm
{4. 5–6. 5kgm}
C – C
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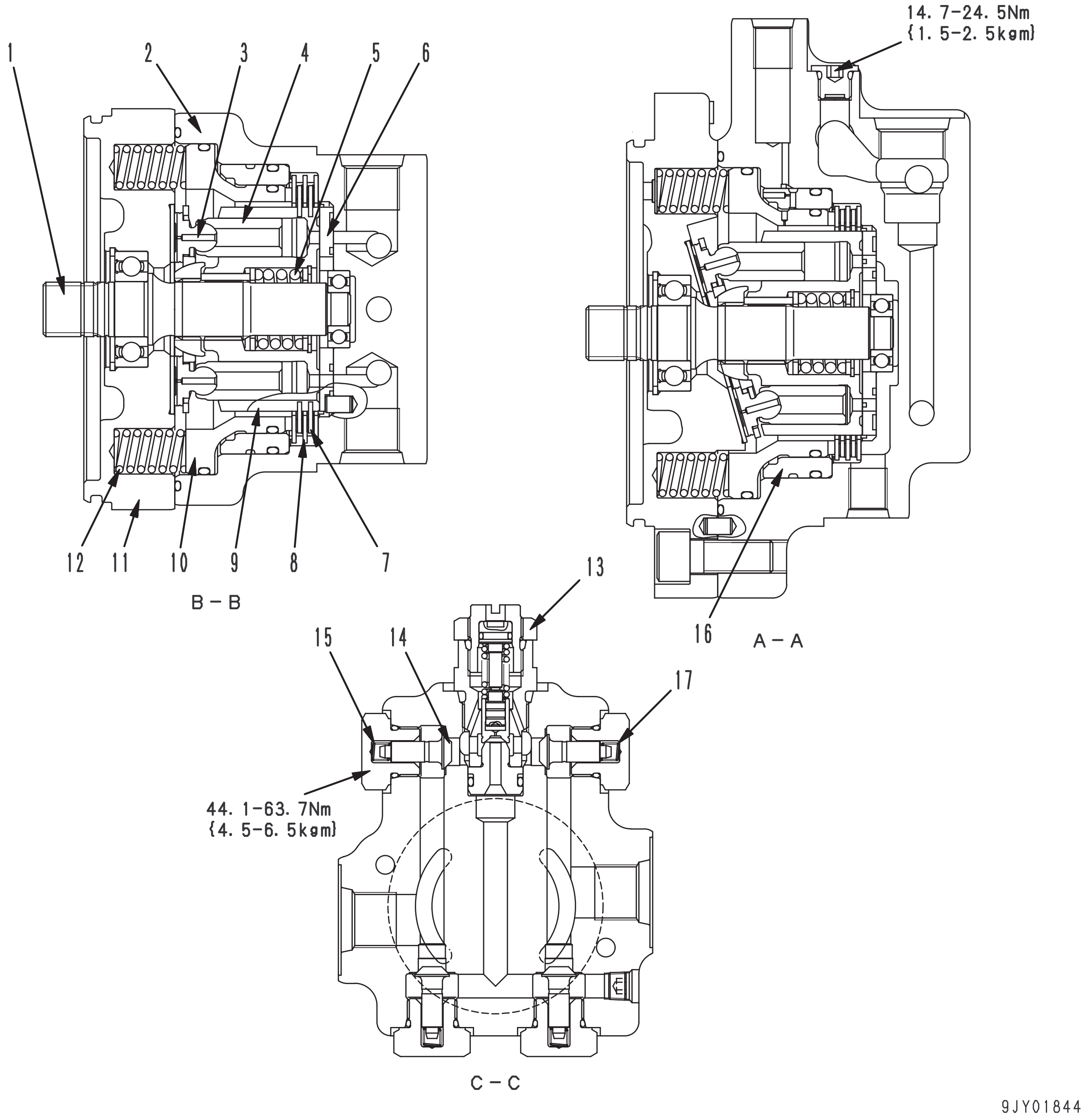
PC30MR, 35MR-2

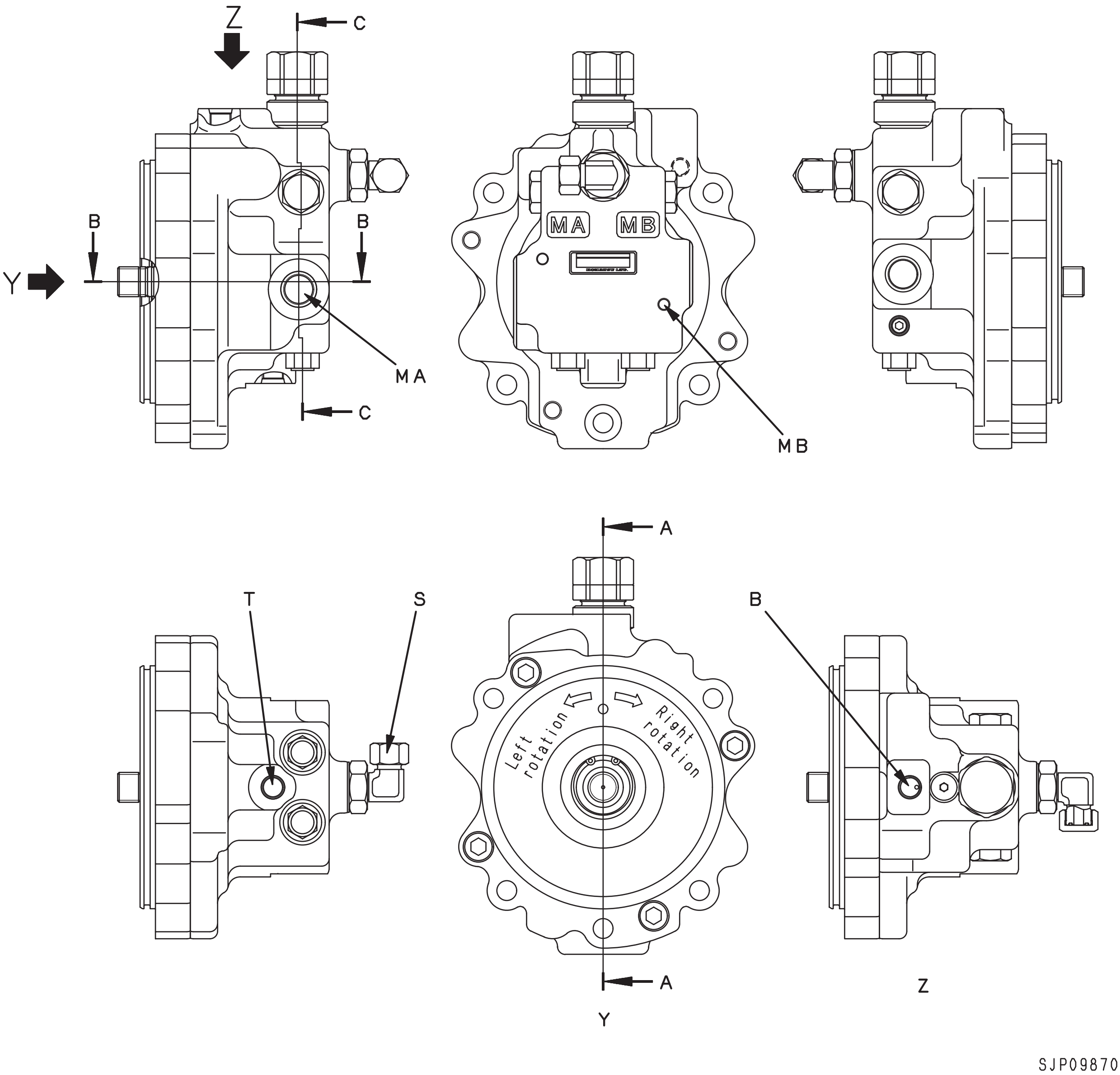


1. Output shaft
2. Housing
3. Shoe
4. Piston
5. Center spring
6. Valve plate
7. Disk
8. Plate
9. Cylinder
10. Brake piston
11. Swash plate
12. Brake spring
13. Safety valve
14. Check valve
15. Check valve spring
16. Brake ring

Unit: mm

No.	Check item	Criteria					Remedy
17	Valve return spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length x OD	Installed length	Installed load	Free length	Installed load	
		13.0 x 6.50	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

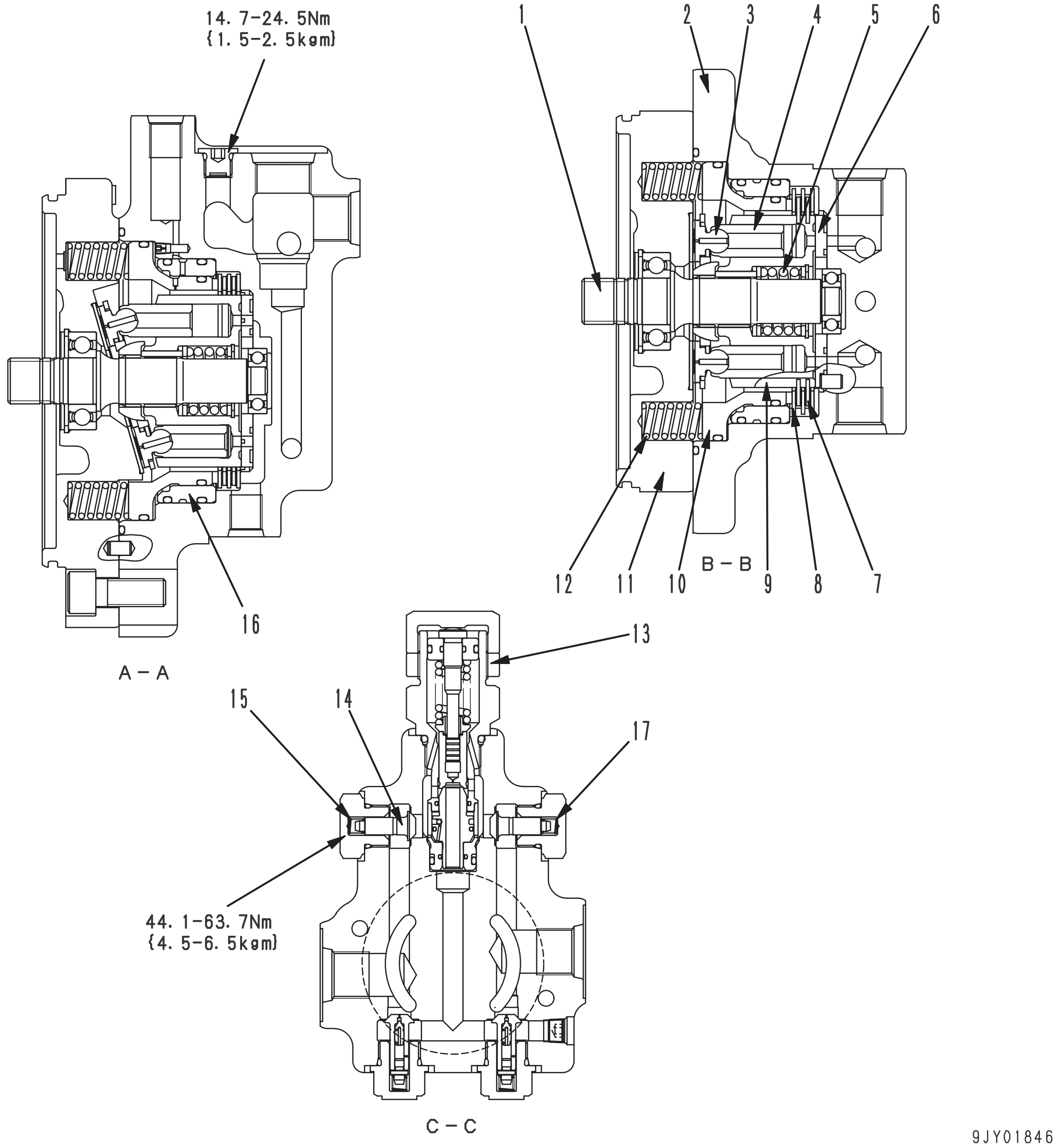
PC40MR, 50MR-2



B : From control valve
S : From tank
T : To tank
MA : From control valve
MB : From control valve

SPECIFICATIONS

- Type : LMF16
- Theoretical discharge : 16.1 cc/rev
- Rated speed : 2,100 rpm
- Rated discharge amount : 34 ℓ/min
- Suction valve cracking pressure :
  0.04 Mpa {0.45 kg/cm^2}
- Safety valve set pressure :
  19.6 Mpa {200 kg/cm^2}



1. Output shaft
2. Housing
3. Shoe
4. Piston
5. Center spring
6. Valve plate
7. Disk
8. Plate
9. Cylinder
10. Brake piston
11. Swash plate
12. Brake spring
13. Safety valve
14. Check valve
15. Check valve spring
16. Brake ring

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
17	Valve return spring	13.0 x 6.50	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	Replace spring if damaged or deformed

HYDRAULIC MOTOR PORTION

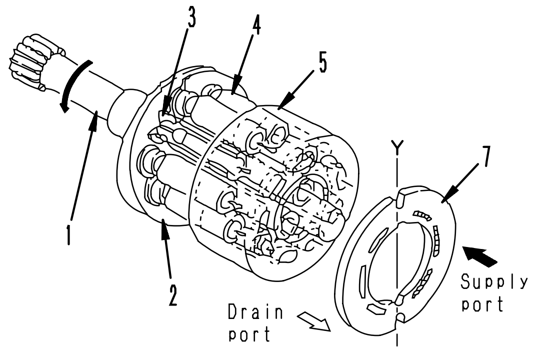
1. Function

This hydraulic motor is a swash plate type axial piston motor, which converts the hydraulic force sent from the hydraulic pump to a rotating movement.

2. Principle of operation

- The oil sent from the hydraulic pump goes from valve plate (7) and enters cylinder block (5).
- The structure of the motor takes in the oil at one side only of the **Y** - **Y** line joining the top and bottom dead centers of the stroke of piston (4).
- The pressure oil entering one side of cylinder block (5) generates force **F1** (**F1**N{kg} = **P** MPa{kg/cm^2} x π/4 **D**^{2}cm^2) pushing each piston (4) (3 or 4 pistons).
- This force acts on thrust plate (2), but thrust plate (2) is secured at a certain angle α° to output shaft (1), so the force is divided into force **F2** and **F3**.
- Of the divided forces, the radial force **F3** generates the torque (**T** = **F3** x **ri**) for line **Y** - **Y** joining the top and bottom dead centers.

  The combined force of this torque {**T** = Σ(**F3** x **ri**)} goes as a rotating force through the piston to rotate cylinder block (5).
- Cylinder block (5) is joined to the output shaft by a spline, so the output shaft rotates and transmits the torque.



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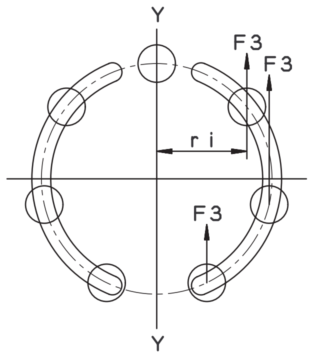

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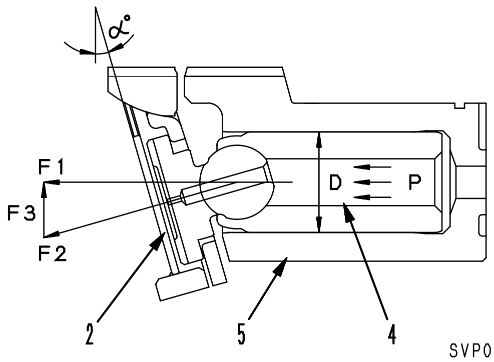


SVP05295

BRAKE VALVE

PC40MR, 50MR-2

OUTLINE

- The brake valve consists of a check valve and a safety valve.

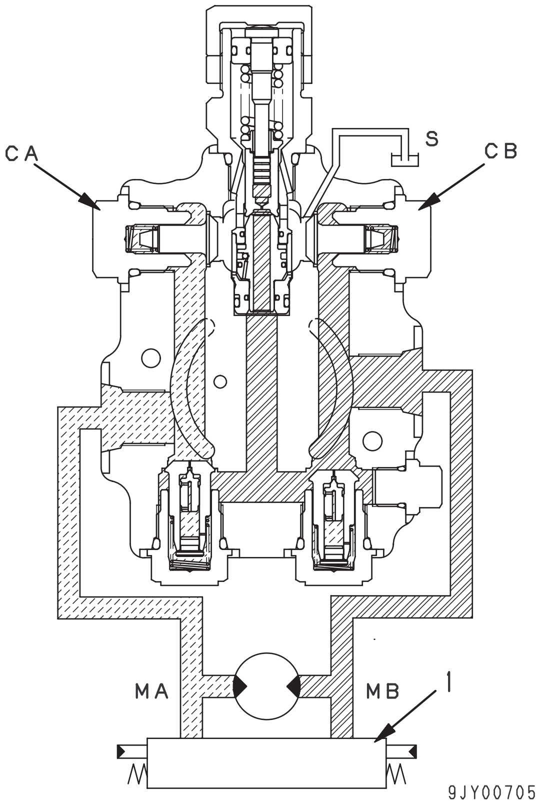
FUNCTION

- When the machine stops swinging, control valve (1) closes the outlet circuit of the motor. Since the motor continues revolving because of the inertia, the motor output pressure rises abnormally to break the motor. Accordingly, the abnormally high pressure is released through the outlet (high pressure side) of the motor to protect the motor.

OPERATION

1. When machine starts swinging

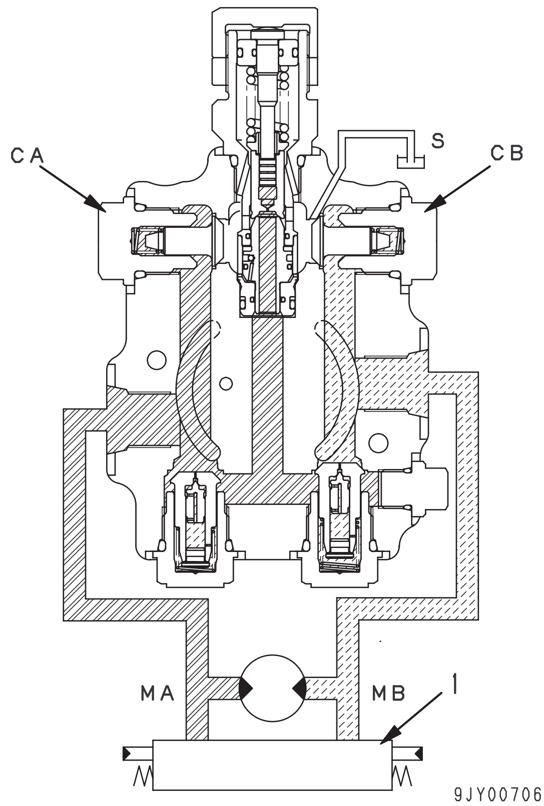
- When the swing control lever is operated to swing to the left, the hydraulic oil from the pump flows through control valve (1) into port **MB**. As a result, the pressure in port **MB** rises and the starting torque is generated in the motor and the motor starts revolution. The oil from the motor outlet returns from port **MA** through control valve (1) to the tank.



9JY00705

2. When machine stops swinging

- If the swing control lever is returned to the neutral position, oil is not supplied from the pump to port **MB** any more. Since the return circuit for the oil from the motor outlet to the tank is closed by control valve (1), the pressure in port **MA** rises and revolution resistance is generated in the motor, then the motor is braked.
- The pressure in port **MA** rises to the set pressure of the safety valve. As a result, high braking torque is generated in the motor, then the motor stops.
- While the safety valve is operating, the oil discharged from the safety valve and the oil from port **S** are supplied through check valve **CB** to port **MB** so that cavitation will not occur in port **MB**.



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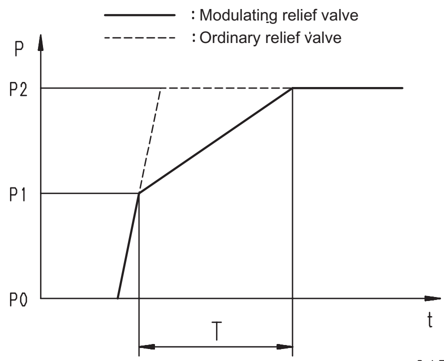
MODULATING RELIEF VALVE

PC40MR, 50MR-2

FUNCTION

The relief valve for the swing motor prevents the relief pressure from rising sharply to reduce shocks when the machine starts and stops swinging.



SJP07984

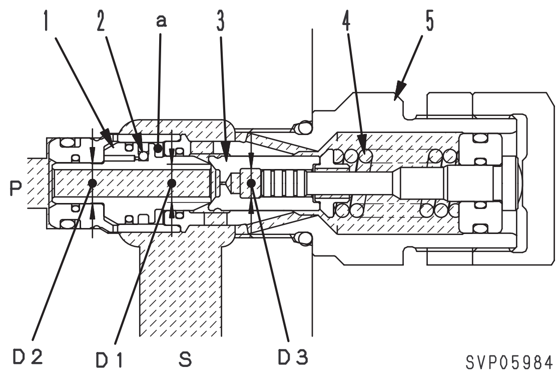
OPERATION

1. When circuit pressure is P0

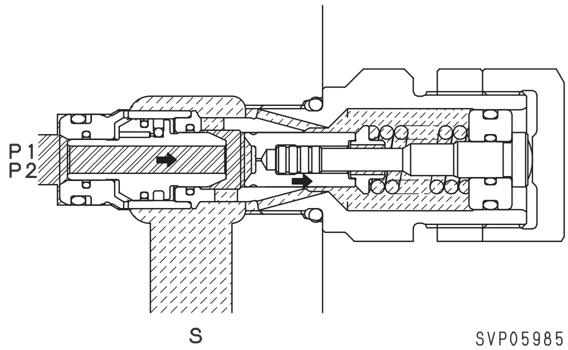
- The relief valve does not operate.

2. When circuit pressure rises sharply

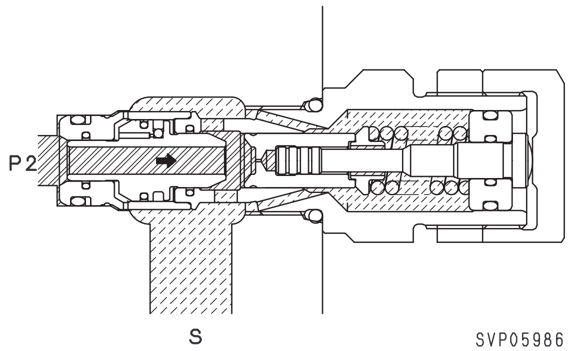
- When circuit pressure rises to **P1**, the hydraulic pressure acts on the area difference between **D1** and **D3** (D1 > D3) and pushes spring (4) to open valve (3).
- At this time, pressure acts on the area difference between **D1** and **D2** (D2 > D1), so seat (1) follows valve (3).
- As seat (1) moves, the passage for the pressurized oil in chamber (a) to flow into port **S** is narrowed by ball (2). Accordingly, seat (1) does not move so fast as valve (3).
- As a result, the relief pressure rises gradually from **P1** to **P2** while seat (1) is moving to sleeve (5).



SVP05984



SVP05985



SVP05986

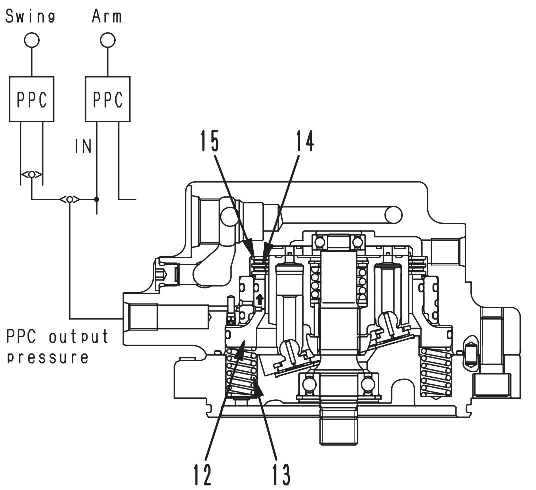
SWING BRAKE

PC27MR-2

OPERATION

1. When swing and arm control levers are in neutral

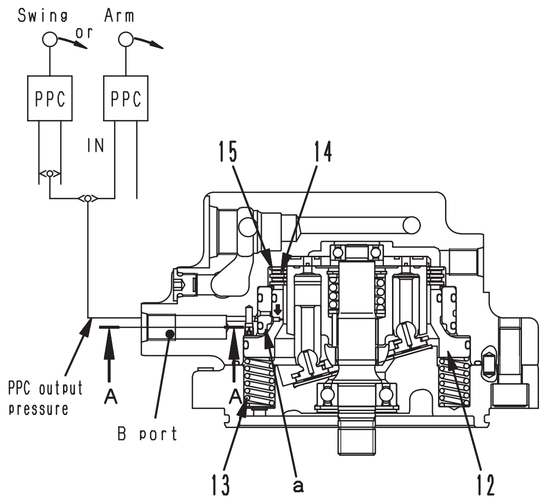
- Since the PPC output pressure is 0 MPa {0 kg/cm²}, brake piston (12) is pushed up by brake spring (13). As a result, disc (14) and plate (15) are pressed and the brake works.



SJP10166

2. When swing and arm control levers are operated

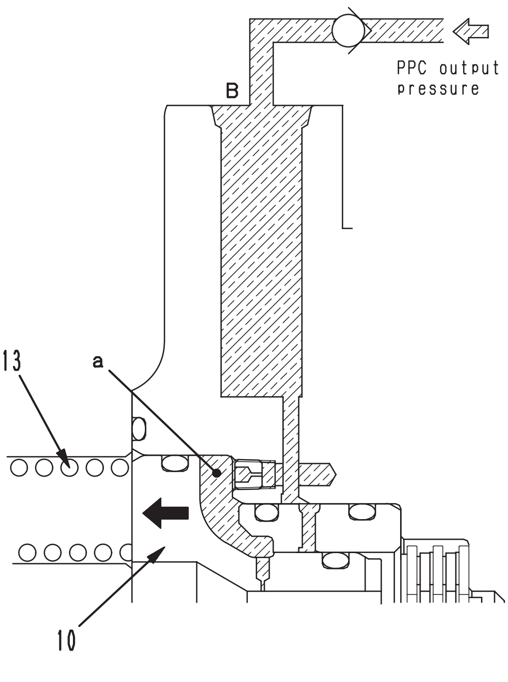
- The PPC output pressure flows through port **B** into brake chamber **a**. The oil in chamber **a** presses down brake spring (13). As a result, brake piston (12) moves down and disc (14) and plate (15) are separated, thus the brake is released.



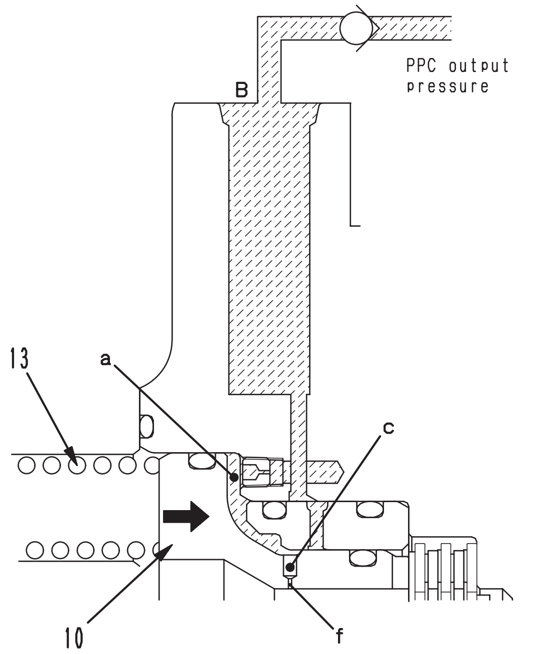
SJP10167

3. Actuation of hydraulic timer

- The hydraulic timer acts to delay the start of the swing brake effect in order to ensure smooth deceleration and to prevent damage to the parts of the motor when the swing motor stops and the swing brake is applied suddenly.
- When the PPC lever is actuated, PPC output pressure is applied to chamber **a** and the swing brake is released. In this condition, if the PPC lever is set in neutral, the supply of pressure oil to port **B** stops and the pressure in chamber **a** drops. As a result, the oil in chamber **a** is pushed out by brake spring (13).
- There is a check valve in the PPC on the port **B** side, so the oil does not flow through but flows out to passage **c**. However, the passage of the oil is throttled by orifice **f** (ø0.5) in the brake piston (10), so the oil in chamber **a** flows out only slowly, and this delays the actuation of the swing brake by the determined amount.



SJP10168



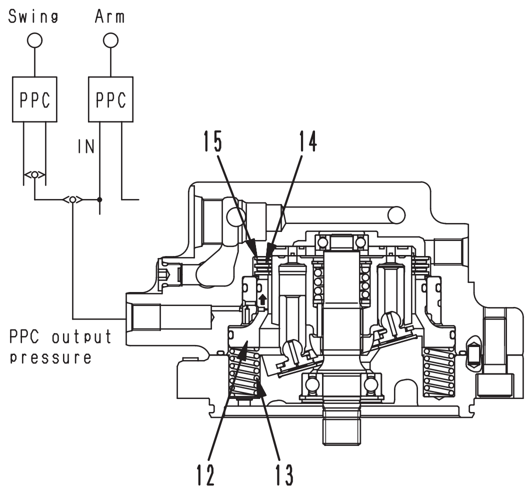
SJP10169

PC30MR, 35MR, 40MR, 50MR-2

OPERATION

1. When swing and arm control levers are in neutral

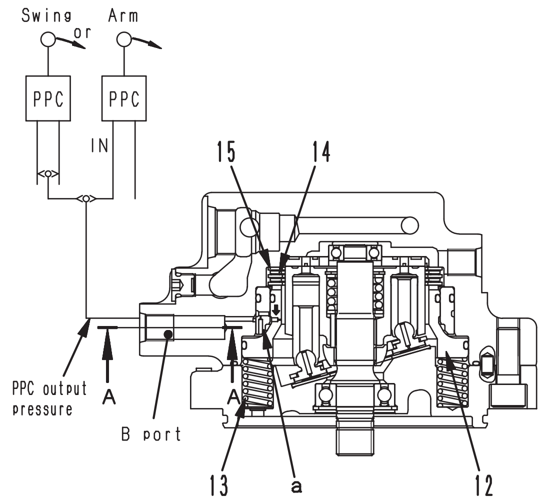
- Since the PPC output pressure is 0 MPa {0 kg/cm^2}, brake piston (12) is pushed up by brake spring (13). As a result, disc (14) and plate (15) are pressed and the brake works.



SJP09871

2. When swing and arm control levers are operated

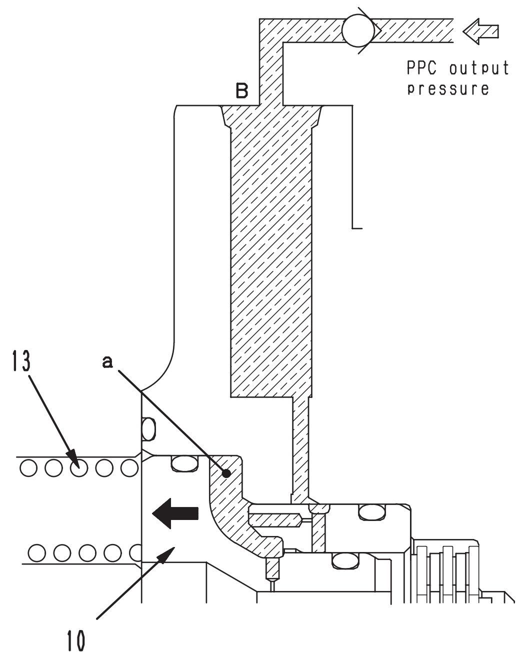
- The PPC output pressure flows through port **B** into brake chamber **a**. The oil in chamber **a** presses down brake spring (13). As a result, brake piston (12) moves down and disc (14) and plate (15) are separated, thus the brake is released.



SJP09872

3. Actuation of hydraulic timer

- The hydraulic timer acts to delay the start of the swing brake effect in order to ensure smooth deceleration and to prevent damage to the parts of the motor when the swing motor stops and the swing brake is applied suddenly.
- When the PPC lever is actuated, PPC output pressure is applied to chamber **a** and the swing brake is released. In this condition, if the PPC lever is set in neutral, the supply of pressure oil to port **B** stops and the pressure in chamber **a** drops. As a result, the oil in chamber **a** is pushed out by brake spring (13).
- There is a check valve in the PPC on the port **B** side, so the oil does not flow through but flows out to passage **c**. However, the passage of the oil is throttled by orifice **f** (ø0.5) in the brake piston (10), so the oil in chamber **a** flows out only slowly, and this delays the actuation of the swing brake by the determined amount.



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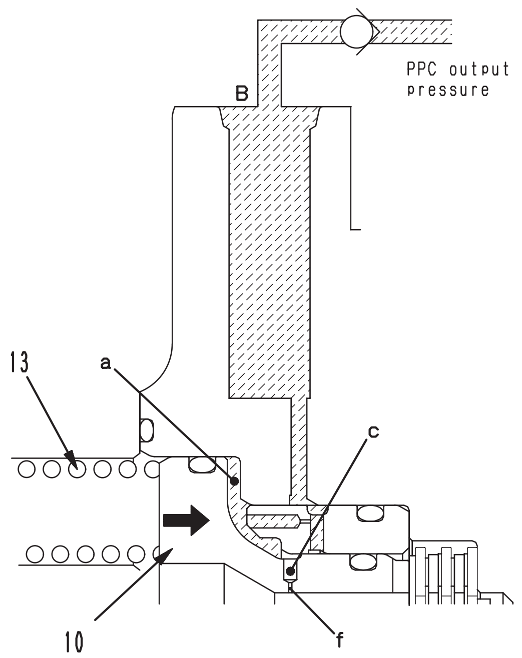
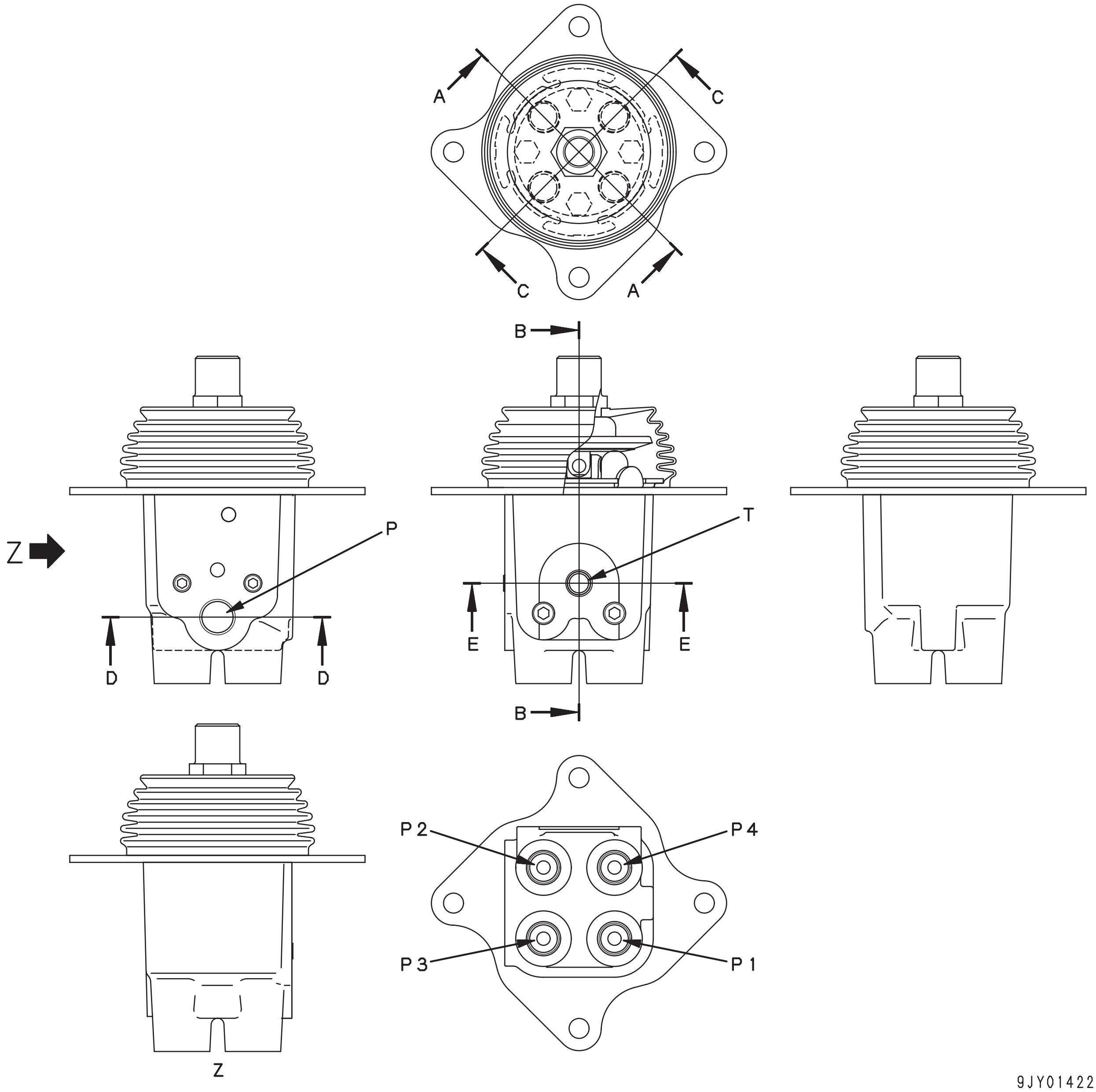


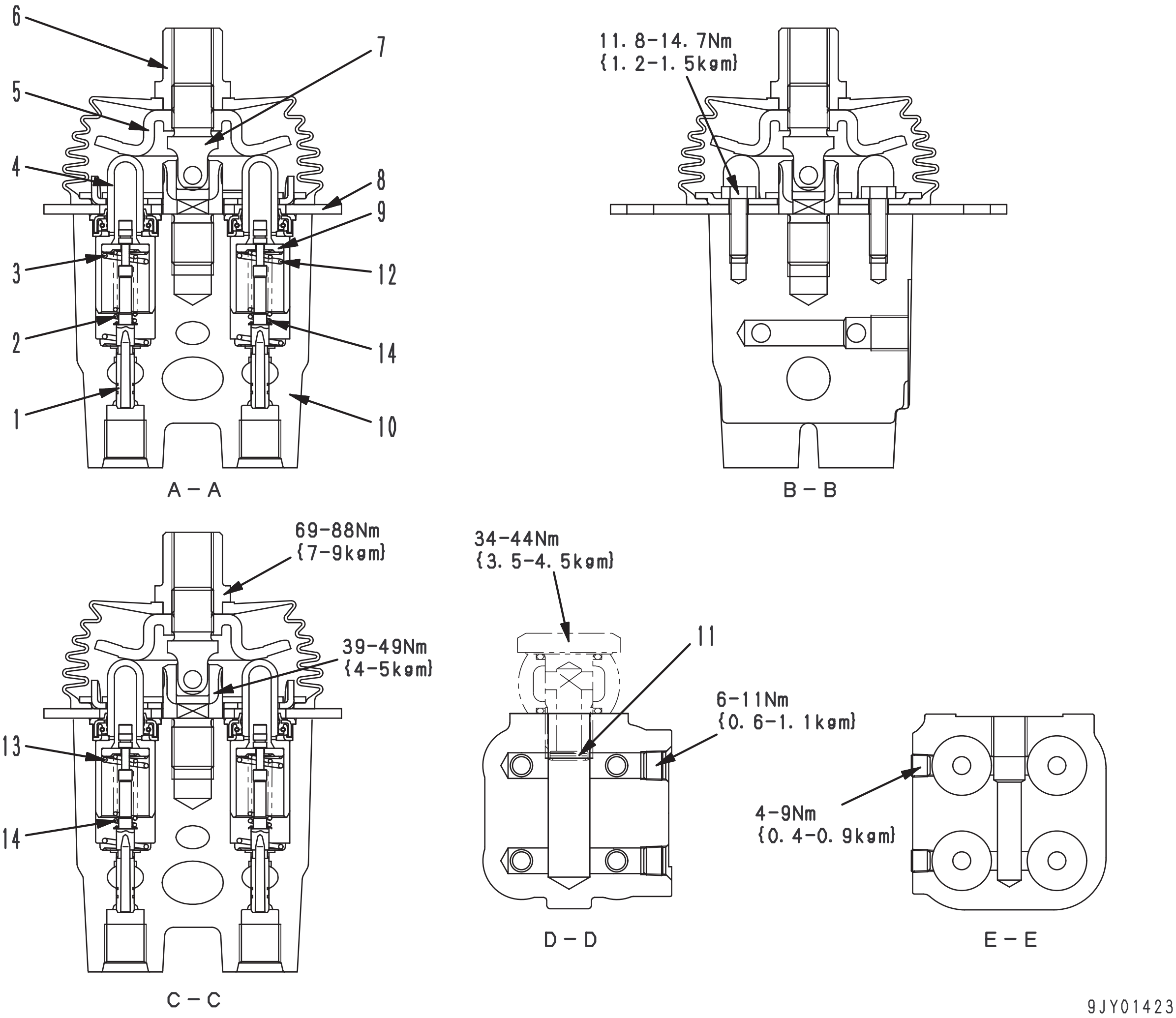
SJP09874

PPC VALVE

1. For work equipment, swing



P : From solenoid valve
T : To tank
P1 : L.H. PPC Arm IN / R.H. PPC Boom RISE
P2 : L.H. PPC Arm OUT / R.H. PPC Boom LOWER
P3 : L.H. PPC Swing RIGHT / R.H. PPC Bucket DUMP
P4 : L.H. PPC Swing LEFT / R.H. PPC Bucket CURL



1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (for connecting lever)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

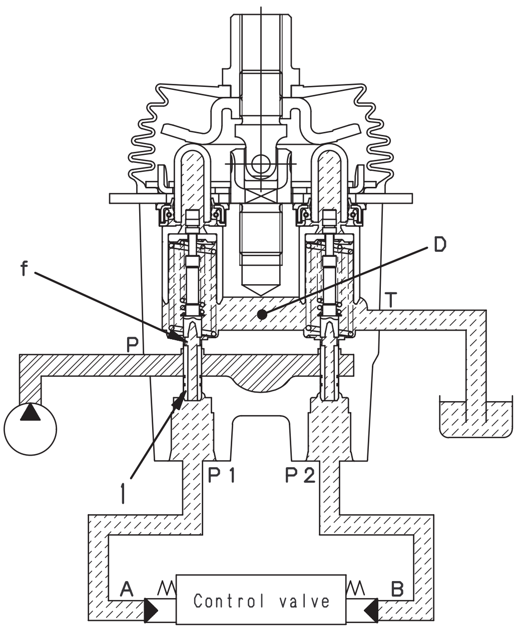
Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
12	Centering spring (for P3, P4 port)	42.4 x 15.5	34.0	17.7 N {1.80 kg}	—	13.7 N {1.40 kg}	Replace spring if damaged or deformed
13	Centering spring (for P1, P2 port)	44.4 x 15.5	34.0	29.4 N {3.0 kg}	—	23.5 N {2.40 kg}	
14	Metering spring	26.5 x 8.20	24.9	16.7 N {1.70 kg}	—	13.7 N {1.40 kg}	

OPERATION

1. At neutral

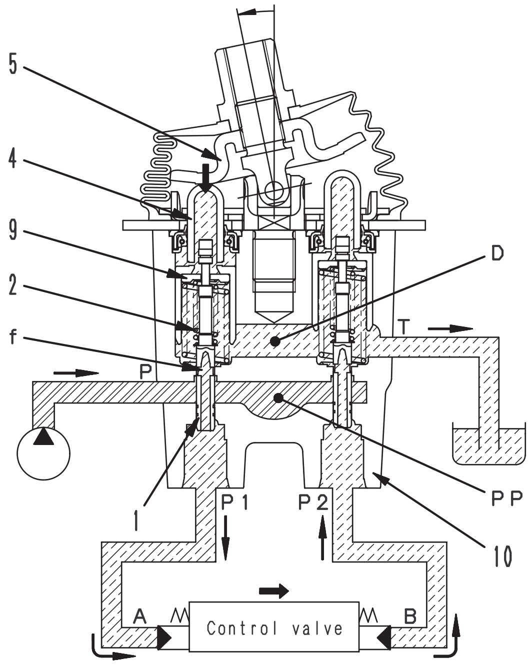
- Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1).



SJP09875

2. During fine control (neutral → fine control)

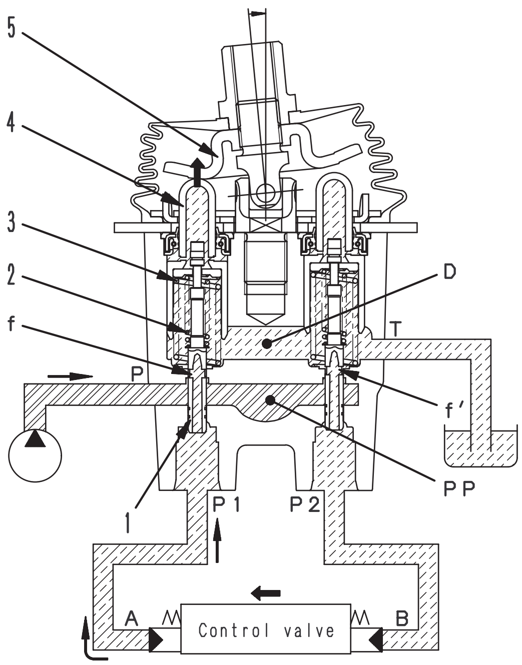
- When piston (4) starts to be pushed by disc (5), retainer (9) is pushed; spool (1) is also pushed by metering spring (2), and moves down.
- When this happens, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **PP**, so pilot pressure oil from the control pump passes through fine control hole **f** and goes from port **P1** to port **A**.
- When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **PP**.
  At almost the same time, it is connected to drain chamber **D** to release the pressure at port **P1**.
- When this happens, spool (1) moves up or down so that the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship in the position of spool (1) and body (10) (fine control hole **f** is at a point midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).
- Therefore, metering spring (2) is compressed proportionally to the amount of movement of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever. In this way, the control valve spool moves to a position where the pressure in chamber **A** (the same as the pressure at port **P1**) and the force of the control valve spool return spring are balanced.



SJP09876

3. During fine control (when control lever is returned)

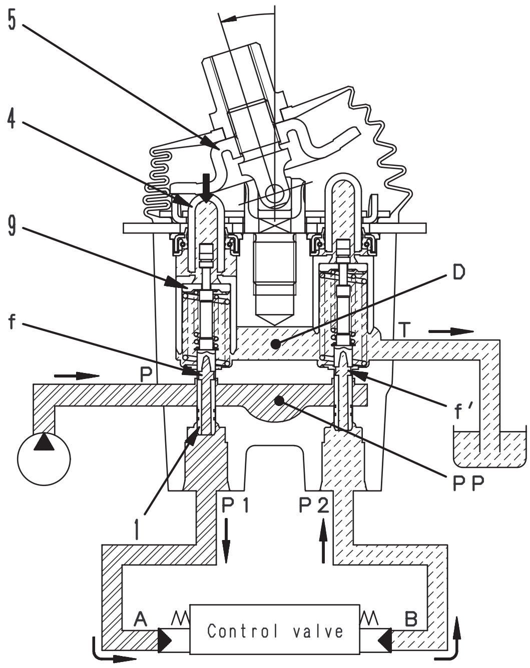
- When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.
- When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.
- If the pressure at port **P1** drops too far, spool (1) is pushed down by metering spring (2), and fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pump pressure is supplied until the pressure at port **P1** recovers to a pressure that corresponds to the lever position.
- When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f'** in the valve on the side that is not working. The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil.



SJP09877

4. At full stroke

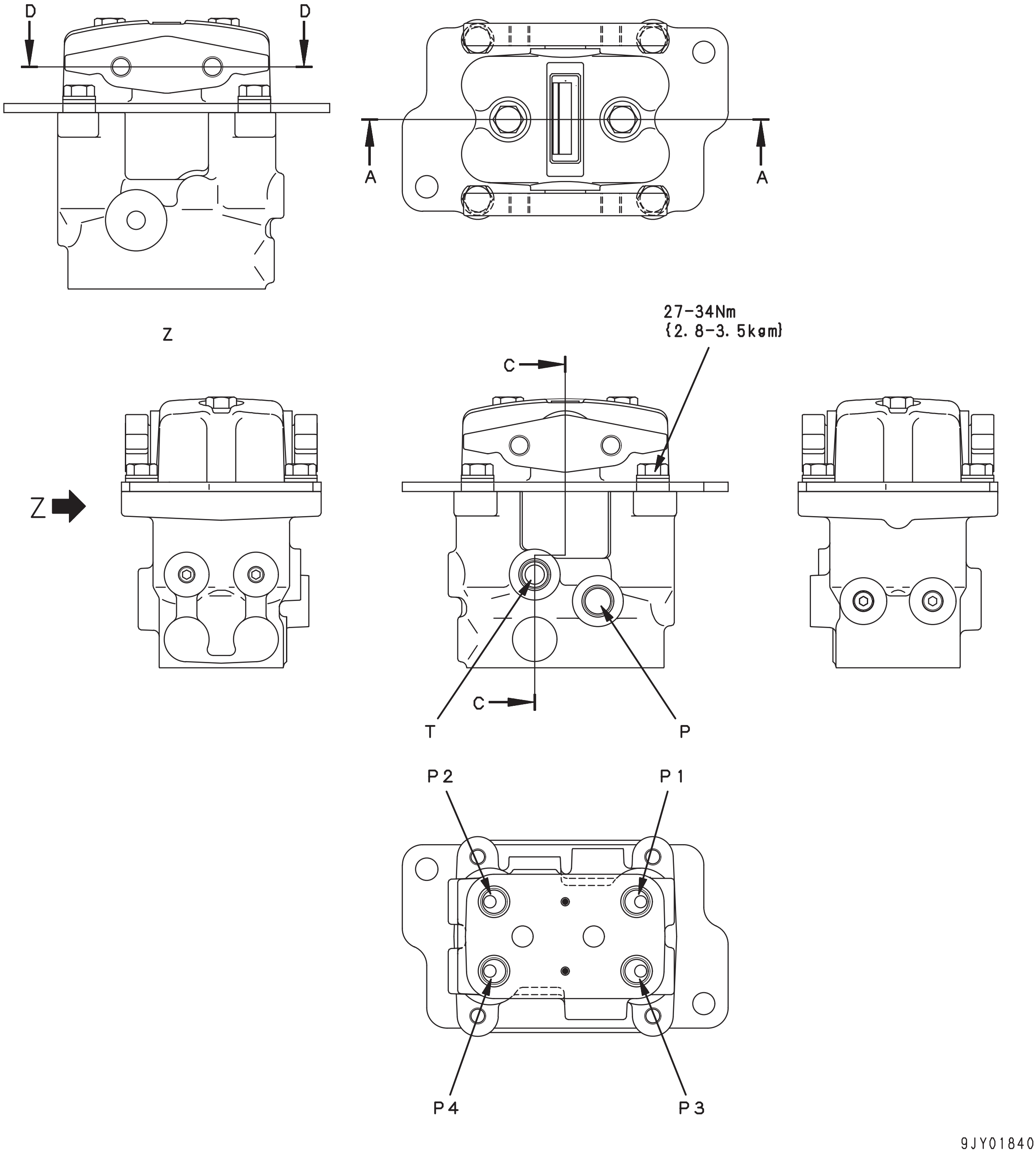
- When disc (5) pushes down piston (4), and retainer (9) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **PP**.
- Therefore, the pilot pressure from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1**, and pushes the control valve spool.
- The oil returning from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**.



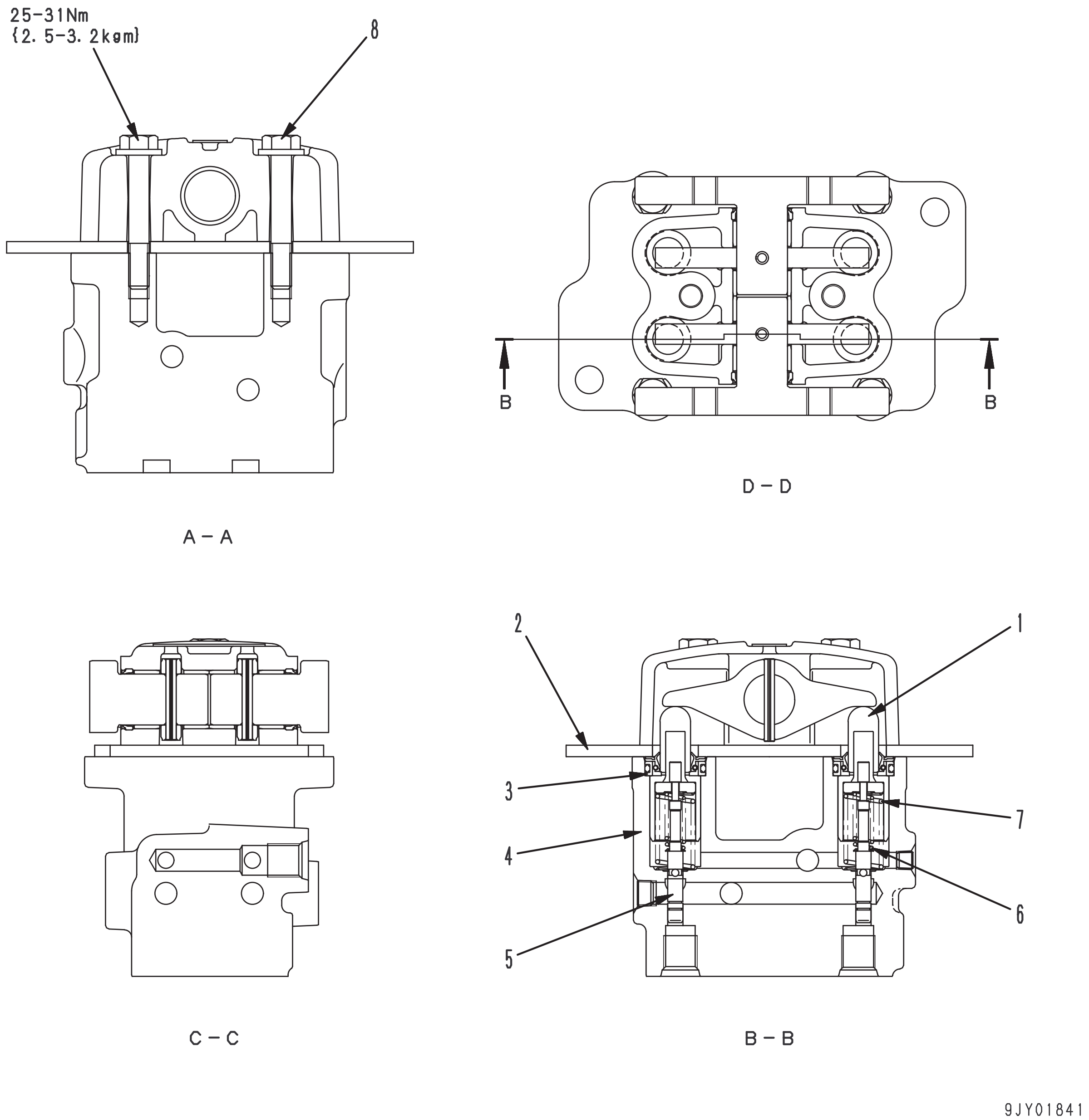
SJP09878

2. For travel

★ For operation, see the sections of the work equipment and swing PPC valve.



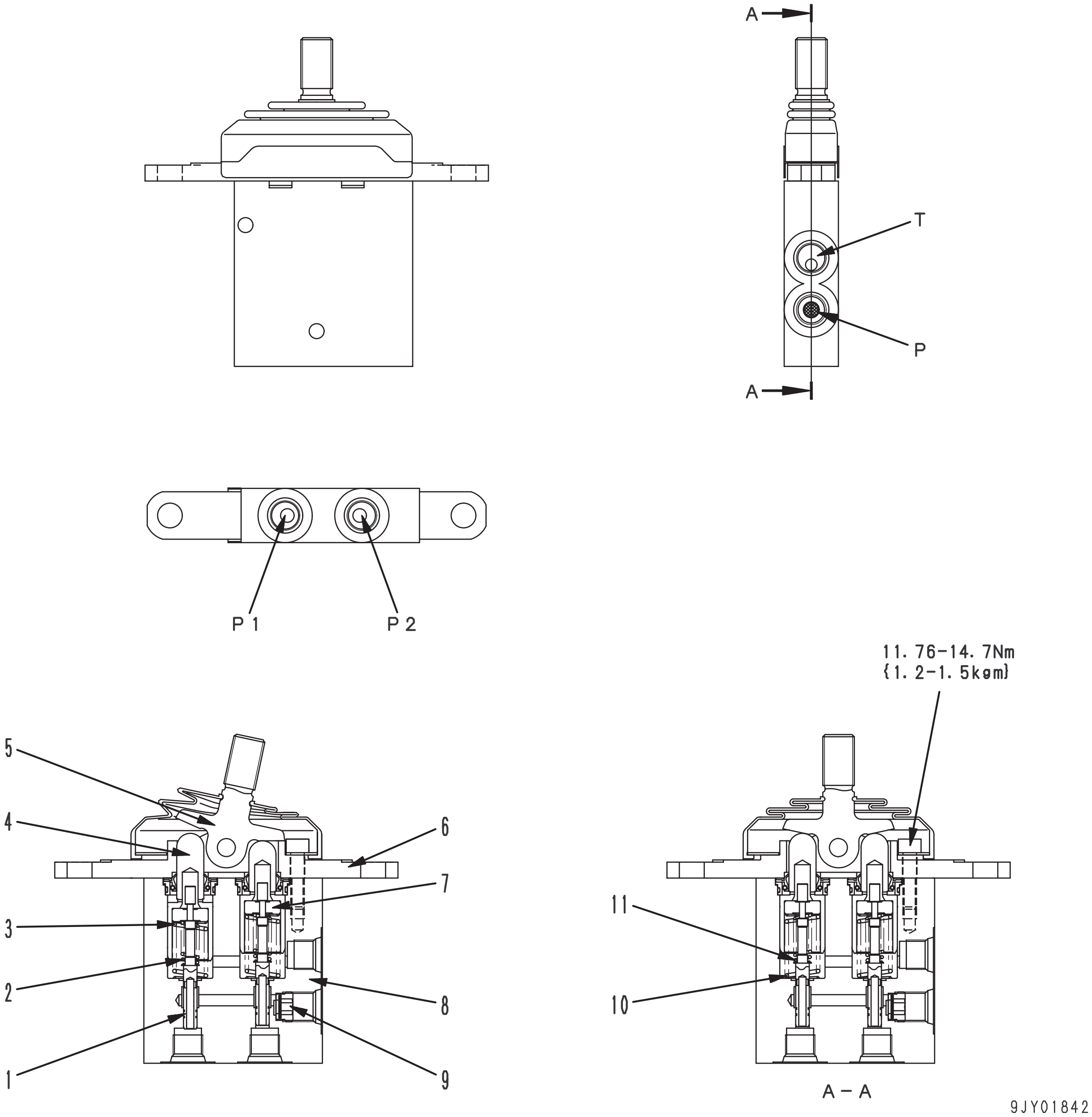
P : From solenoid valve
T : To tank
P1 : Right forward
P2 : Right reverse
P3 : Left forward
P4 : Left reverse



1. Piston
2. Plate
3. Collar
4. Body
5. Valve
6. Metering spring
7. Centering spring
8. Bolt

3. For blade, boom swing and attachment PPC valve

★ For operation, see the sections of the work equipment and swing PPC valve.



P : From solenoid valve
T : To tank
P1 : To blade, boom swing and attachment valve
P2 : To blade, boom swing and attachment valve

1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Lever
6. Plate
7. Retainer
8. Body
9. Filter

For blade PPC valve: PC30MR, 35MR, 40MR, 50MR-2

Unit: mm

No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
10	Centering spring	42.4 x 15.5	32.5	147 N {15 kg}	—	118 N {12 kg}	Replace spring if damaged or deformed
11	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

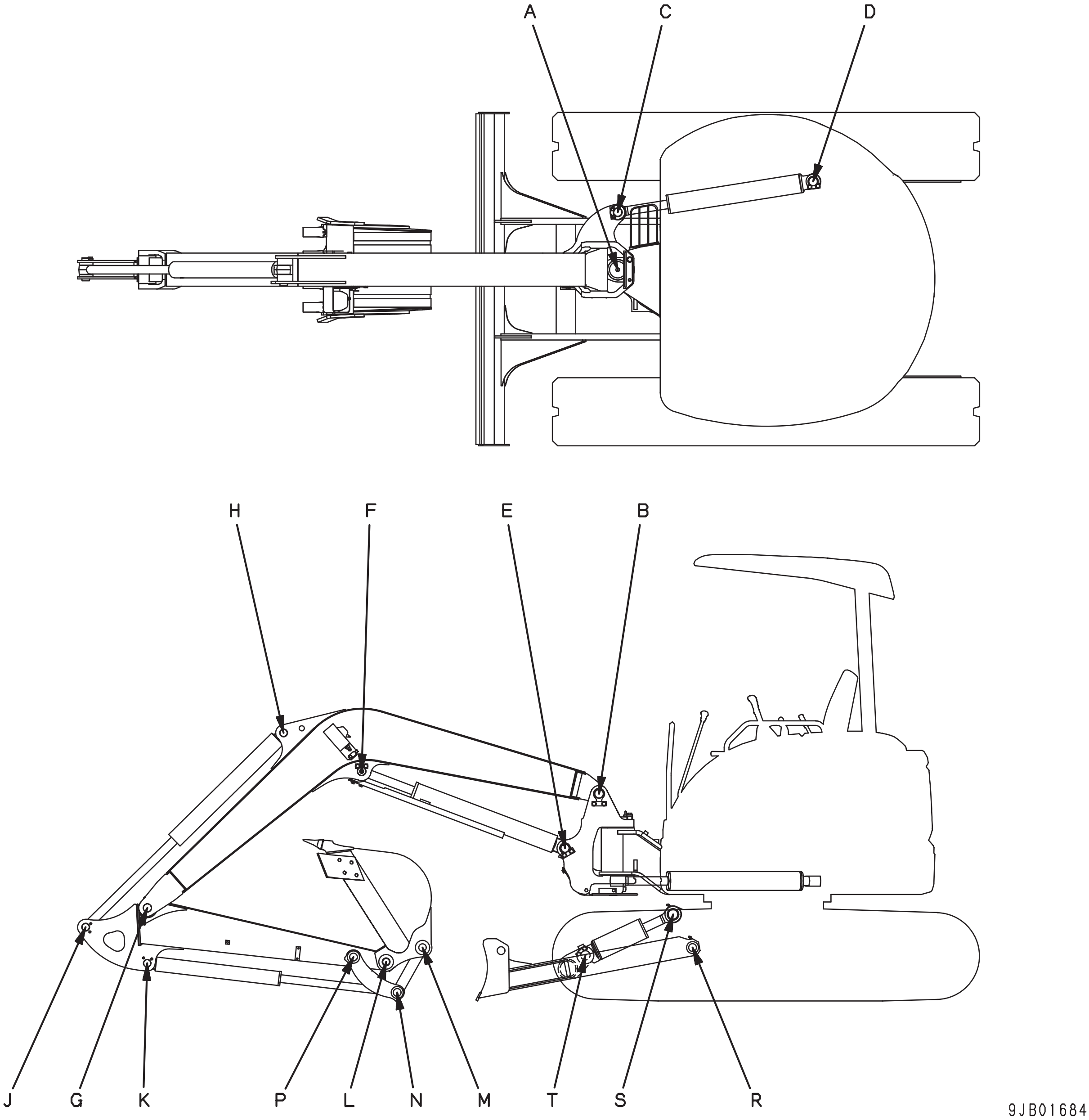
For blade PPC valve: PC27MR-2
For boom swing, attachment PPC valve: PC30MR, 35MR, 40MR, 50MR-2

Unit: mm

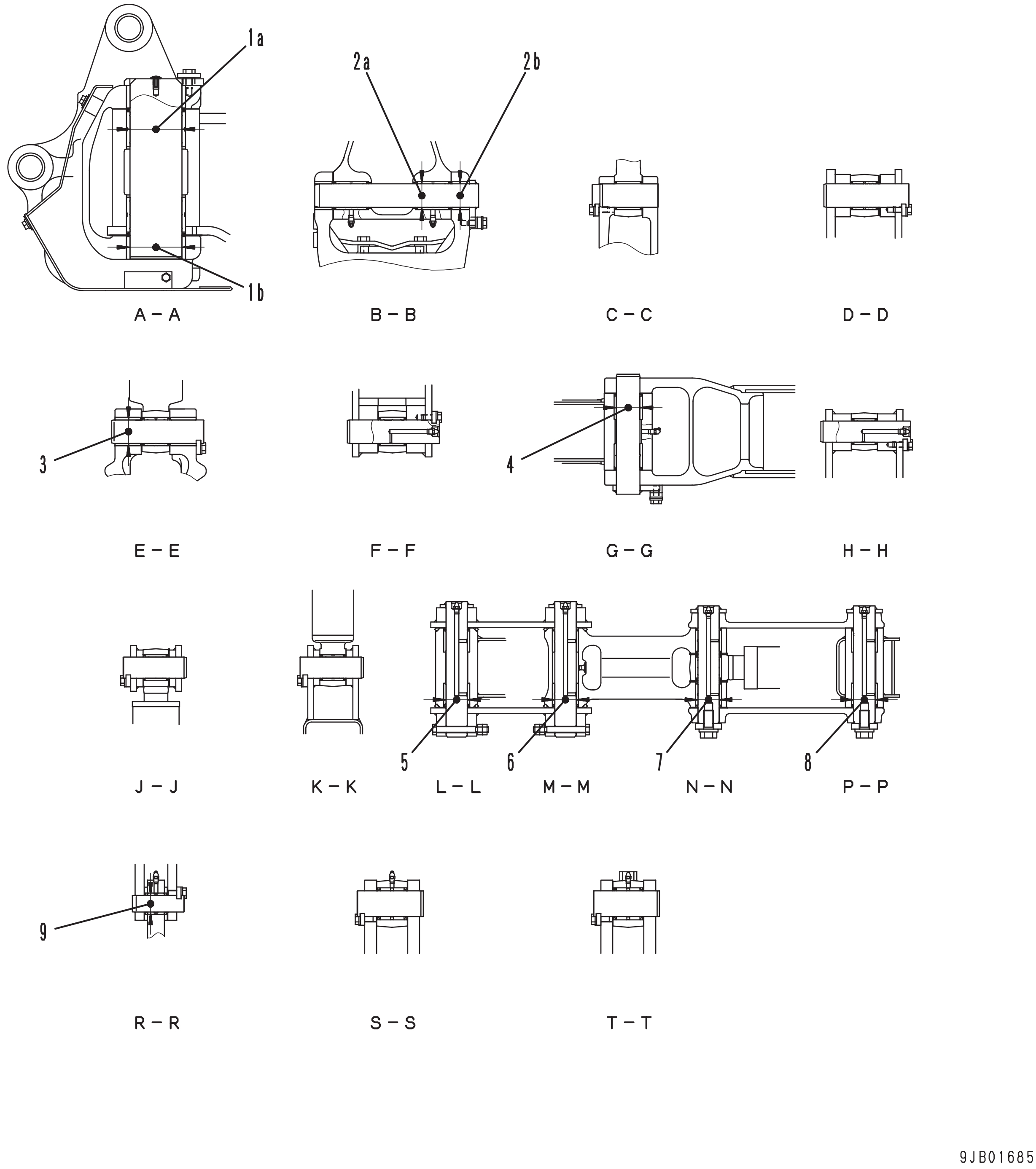
No.	Check item	Criteria					Remedy
		Standard clearance			Repair limit		
		Free length x OD	Installed length	Installed load	Free length	Installed load	
10	Centering spring	33.9 x 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	Replace spring if damaged or deformed
11	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

WORK EQUIPMENT

★ This diagram shows PC40MR.



★ This diagram shows PC40MR.



Unit: mm

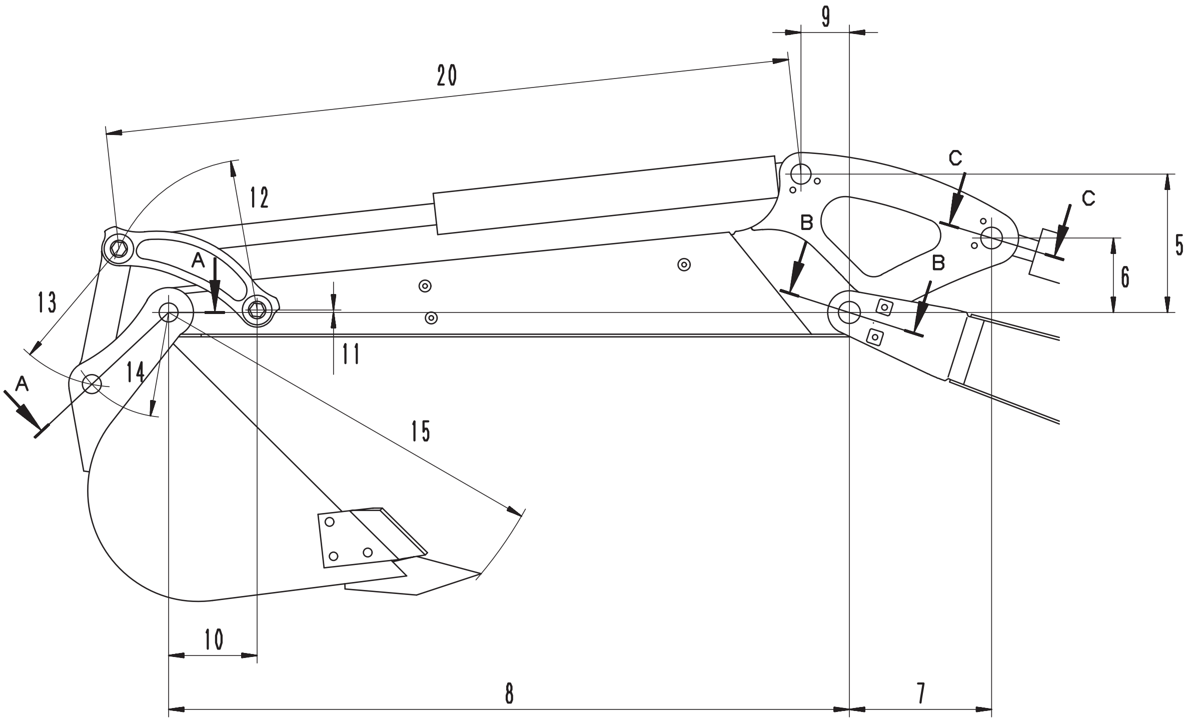
No.	Check item		Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	Remedy
1a	Clearance between mounting pin of revolving frame and swing bracket and bushing	PC27MR-2 PC30MR-2	ø 95	– 0.036 – 0.090	+ 0.134 + 0.061	0.097 – 0.224	1.0	Replace pin and bushing
		PC35MR-2	ø 100		+ 0.136 + 0.064	0.100 – 0.226		
		PC40MR-2 PC50MR-2	ø 120		+ 0.204 + 0.128	0.164 – 0.294		
1b		PC40MR-2 PC50MR-2	ø 120		+ 0.054 0	0.036 – 0.144		
2a	Clearance between mounting pin of swing bracket and boom and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 45	– 0.025 – 0.064	+ 0.128 + 0.075	0.100 – 0.192	1.0	
		PC40MR-2 PC50MR-2	ø 50		+ 0.142 + 0.080	0.105 – 0.206		
2b		PC40MR-2 PC50MR-2	ø 50		+ 0.039 0	0.025 – 0.103		
3	Clearance between mounting pin of swing bracket and boom cylinder and bushing	PC40MR-2 PC50MR-2	ø 50	– 0.025 – 0.087	+ 0.039 0	0.025 – 0.126	1.0	
4	Clearance between mounting pin of boom and arm and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 40	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
		PC40MR-2 PC50MR-2	ø 50					
5	Clearance between mounting pin of arm and bucket and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.170 – 0.230	– 0.012 – 0.065	0.105 – 0.197	1.0	
		PC40MR-2 PC50MR-2	ø 45			0.105 – 0.218		
6	Clearance between mounting pin of link and bucket and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.170 – 0.209	– 0.012 – 0.065	0.105 – 0.197	1.0	
		PC40MR-2 PC50MR-2	ø 45					
7	Clearance between mounting pin of links and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.170 – 0.230	– 0.012 – 0.065	0.105 – 0.218	1.0	
		PC40MR-2 PC50MR-2	ø 45					
8	Clearance between mounting pin of arm and link and bushing	PC27MR-2 PC30MR-2 PC35MR-2	ø 35	– 0.170 – 0.230	– 0.012 – 0.065	0.105 – 0.218	1.0	
		PC40MR-2 PC50MR-2	ø 45					
9	Clearance between mounting pin of track frame and blade and bushing	PC27MR-2 PC30MR-2 PC35MR-2 PC40MR-2 PC50MR-2	ø 35	– 0.025 – 0.087	+ 0.142 + 0.080	0.105 – 0.229	1.0	

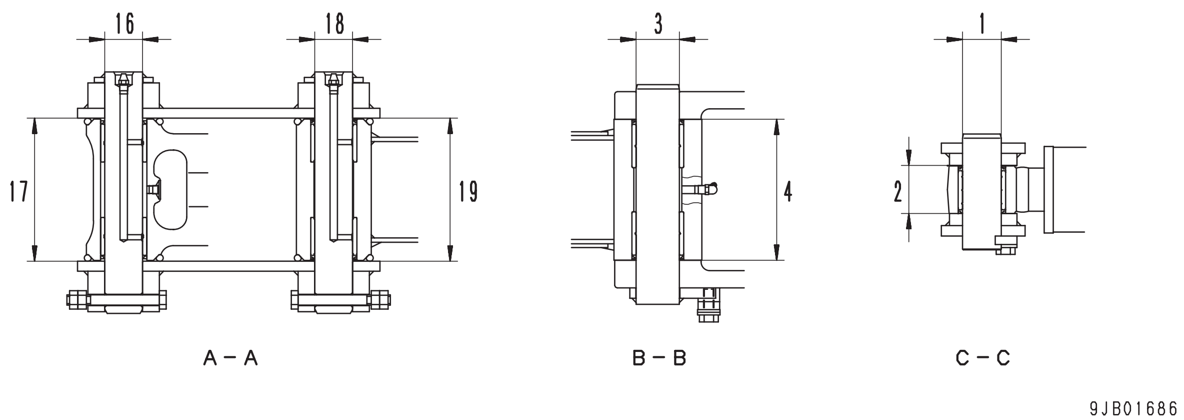
DIMENSIONS OF EACH PART OF WORK EQUIPMENT

ARM SECTION

PC27MR, 30MR, 35MR-2

★ The following figure shows PC30MR.





Unit: mm

No.	PC27MR-2			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	ø 35	– 0.025 – 0.064	+ 0.039 0
2	Arm side	46	+ 1 0	
	Cylinder head side	45	0 – 0.5	
3	—	ø 40	– 0.025 – 0.064	+ 0.039 0
4	Boom side	124	+ 0.5 0	
	Arm side	123.5	0 – 0.5	
5	—	261	± 1	
6	—	163.9	± 1	
7	—	266.3	± 1	
8	—	1,111	± 3	
9	—	8.1	± 1	
10	—	174	± 1	
11	—	6	± 1	
12	—	265.5	± 0.5	
13	—	250.5	± 0.5	
14	—	200	± 0.2	
15	—	659	—	
16	—	ø 35	– 0.170 – 0.209	– 0.050 – 0.089
17	Link side	143.5	0 – 0.5	
	Bucket side	145	± 1	
18	—	ø 35	– 0.170 – 0.209	– 0.050 – 0.089
19	Arm side	143.5	0 – 0.5	
	Bucket side	145	± 1	
20	Min.	806	± 1	
	Max.	1,350	—	

Unit: mm

No.	PC30MR-2			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	ø 40	– 0.025 – 0.064	+ 0.039 0
2	Arm side	51	+ 1 0	
	Cylinder head side	50	0 – 0.5	
3	—	ø 40	– 0.025 – 0.064	+ 0.039 0
4	Boom side	124	+ 0.5 0	
	Arm side	123.5	0 – 0.5	
5	—	256.3	± 1	
6	—	138	± 1	
7	—	263	± 1	
8	—	1,260	± 3	
9	—	89.8	± 1	
10	—	163.6	± 1	
11	—	4.5	± 1	
12	—	280	± 0.5	
13	—	256	± 0.5	
14	—	194.6	± 0.2	
15	—	754	—	
16	—	ø 35	– 0.170 – 0.209	– 0.050 – 0.089
17	Link side	143.5	0 – 0.5	
	Bucket side	145	± 1	
18	—	ø 35	– 0.170 – 0.209	– 0.050 – 0.089
19	Arm side	143.5	0 – 0.5	
	Bucket side	145	± 1	
20	Min.	780	± 1	
	Max.	1,270	—	

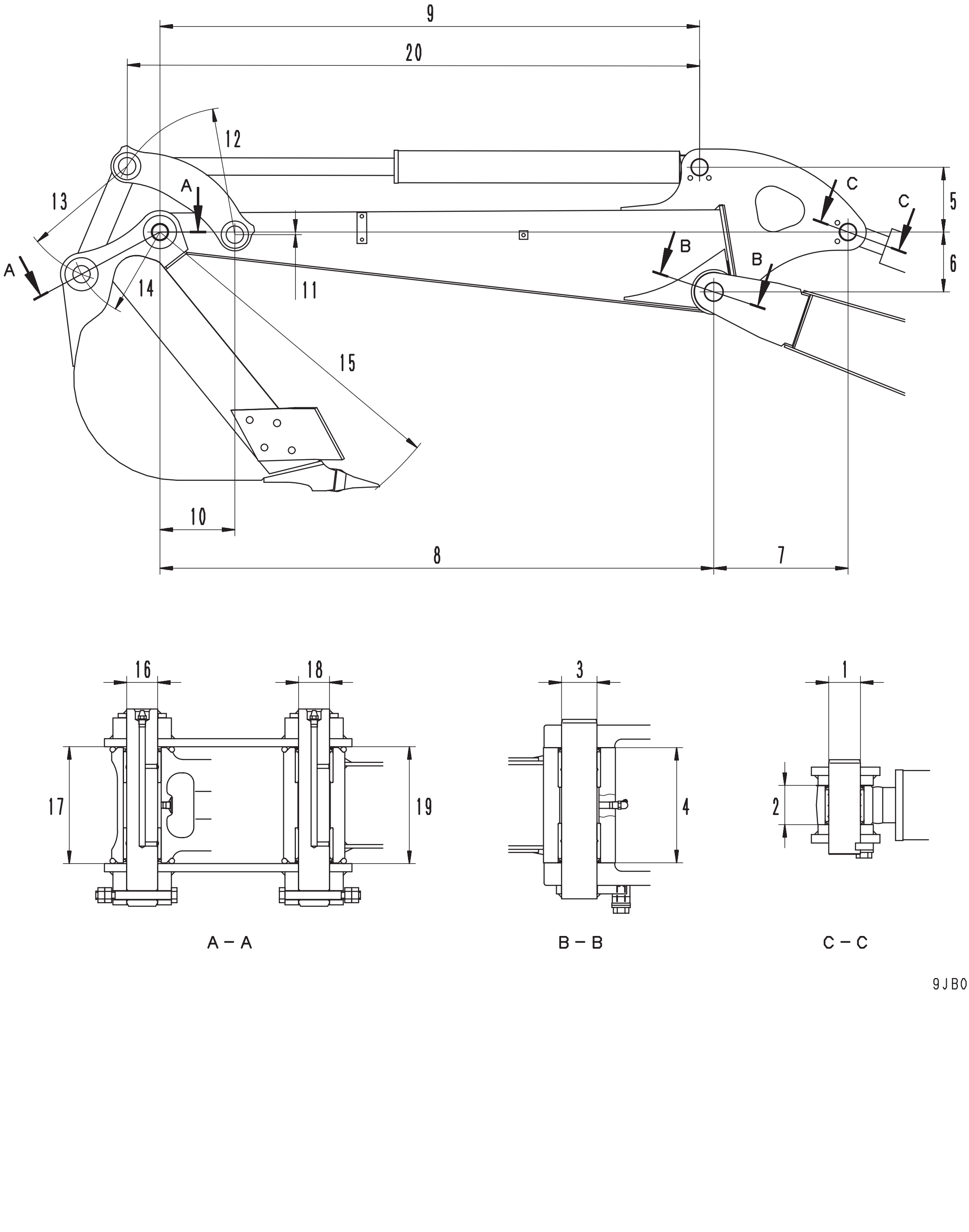
Unit: mm

No.	PC35MR-2			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	ø 40	– 0.025 – 0.064	+ 0.039 0
2	Arm side	51	+ 1 0	
	Cylinder head side	50	0 – 0.5	
3	—	ø 40	– 0.025 – 0.064	+ 0.039 0
4	Boom side	130	+ 0.5 0	
	Arm side	130	0 – 0.5	
5	—	256.7	± 1	
6	—	120.2	± 1	
7	—	335	± 1	
8	—	1,350	± 3	
9	—	173.7	± 1	
10	—	163.4	± 1	
11	—	9.6	± 1	
12	—	280	± 0.5	
13	—	256	± 0.5	
14	—	194.6	± 0.5	
15	—	754	—	
16	—	ø 35	– 0.170 – 0.209	0 – 0.040
17	Link side	143.5	0 – 0.5	
	Bucket side	145	± 1	
18	—	ø 35	– 0.170 – 0.209	0 – 0.040
19	Arm side	143.5	0 – 0.5	
	Bucket side	145	± 1	
20	Min.	780	± 1	
	Max.	1,270	—	

ARM SECTION

PC40MR, 50MR-2

★ The following figure shows PC40MR.



Unit: mm

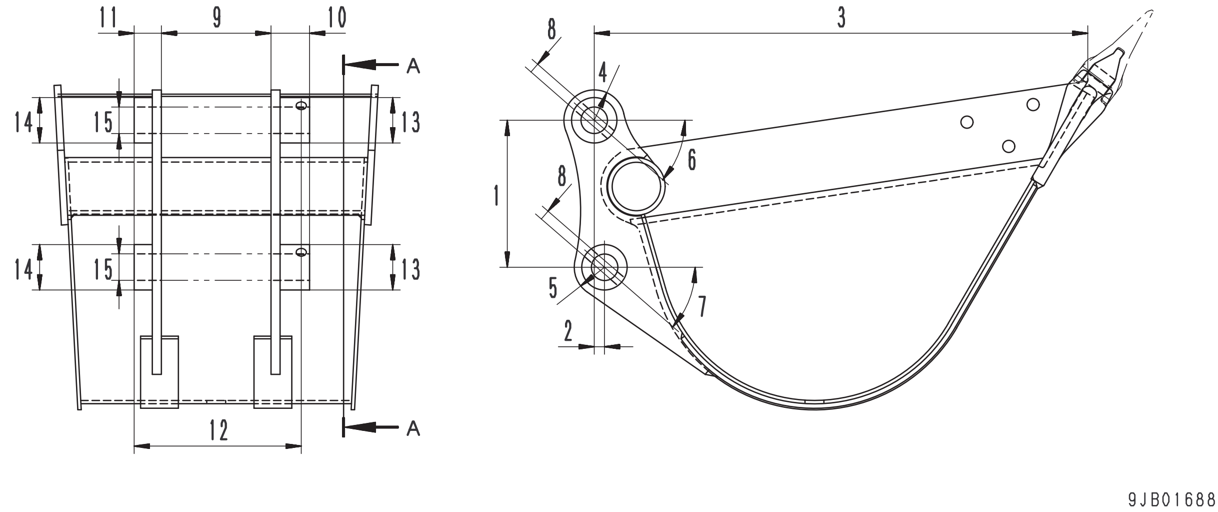
No.	PC40MR-2			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	ø 45	– 0.025 – 0.064	+ 0.1 0
2	Arm side	55.5	+ 1 0	
	Cylinder head side	55	0 – 0.5	
3	—	ø 50	– 0.025 – 0.064	+ 0.039 0
4	Boom side	163	+ 0.5 0	
	Arm side	163	– 0.3 – 1.0	
5	—	167.7	± 1	
6	—	155	+ 1 0	
7	—	347.2	+ 1 0	
8	—	1,431.6	—	
9	—	1,395	± 1	
10	—	193.5	± 1	
11	—	8.4	± 1	
12	—	330	± 0.5	
13	—	303	± 0.5	
14	—	230.3	± 0.5	
15	—	871	—	
16	—	ø 45	– 0.170 – 0.230	– 0.050 – 0.089
17	Link side	168	+ 0.7 + 0.2	
	Bucket side	170	± 1	
18	—	ø 45	– 0.170 – 0.230	– 0.050 – 0.089
19	Arm side	168	+ 0.7 + 0.2	
	Bucket side	170	± 1	
20	Min.	900	± 1.5	
	Max.	1,480	—	

Unit: mm

No.	PC50MR-2			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	ø 45	– 0.025 – 0.064	+ 0.1 0
2	Arm side	55.5	+ 1 0	
	Cylinder head side	55	0 – 0.5	
3	—	ø 50	– 0.025 – 0.064	+ 0.039 0
4	Boom side	163	+ 0.5 0	
	Arm side	163	– 0.3 – 1.0	
5	—	180.5	± 1	
6	—	161.5	+ 1 0	
7	—	393.1	+ 1 0	
8	—	1,632	—	
9	—	1,389	± 1	
10	—	193.6	± 1	
11	—	6.3	± 1	
12	—	330	± 0.5	
13	—	303	± 0.5	
14	—	230.3	± 0.5	
15	—	871	—	
16	—	ø 45	– 0.170 – 0.230	– 0.050 – 0.089
17	Link side	168	+ 0.7 + 0.2	
	Bucket side	170	± 1	
18	—	ø 45	– 0.170 – 0.230	– 0.050 – 0.089
19	Arm side	168	+ 0.7 + 0.2	
	Bucket side	170	± 1	
20	Min.	900	± 1.5	
	Max.	1,480	—	

BUCKET SECTION

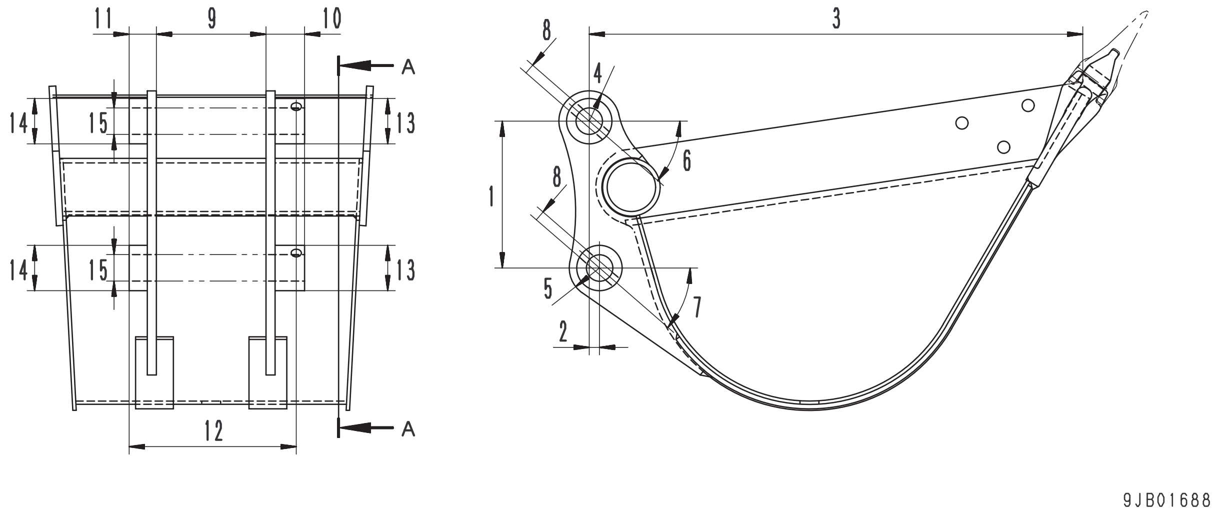
PC27MR-2



Unit: mm

No.	PC27MR-2		
	Measuring point	Standard size	Tolerance
1	—	199.9	—
2	—	6.3	—
3	—	567	—
4	—	42	—
5	—	42	—
6	—	45°	—
7	—	45°	—
8	—	ø 13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	ø 60	—
14	—	ø 60	—
15	—	ø 35	– 0.050 – 0.089

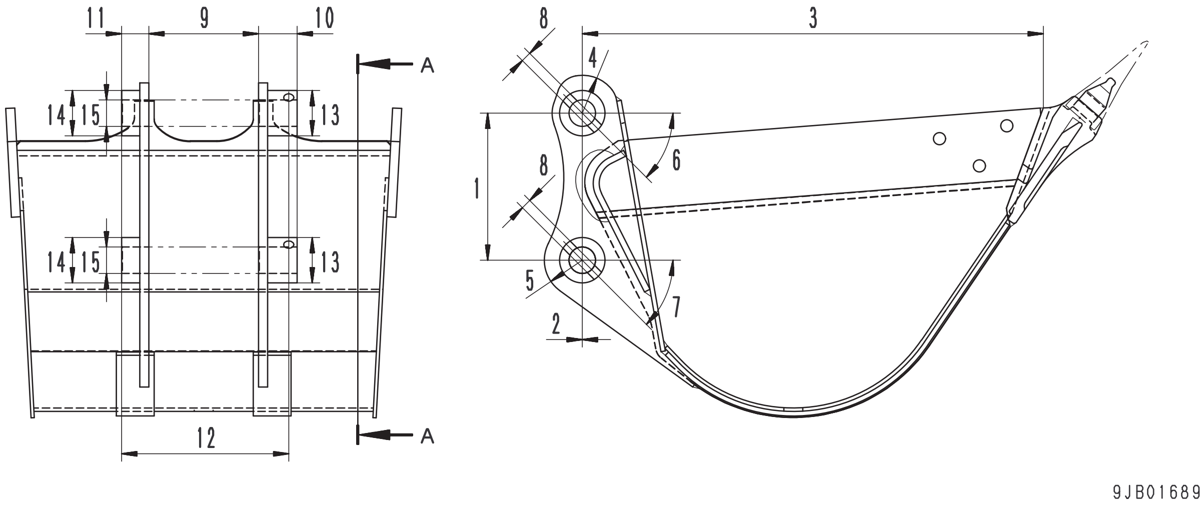
PC30MR-2



Unit: mm

No.	PC30MR-2		
	Measuring point	Standard size	Tolerance
1	—	194	—
2	—	13.6	—
3	—	653	—
4	—	40	—
5	—	40	—
6	—	49°	—
7	—	45°	—
8	—	ø 13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	ø 60	—
14	—	ø 60	—
15	—	ø 35	– 0.050 – 0.089

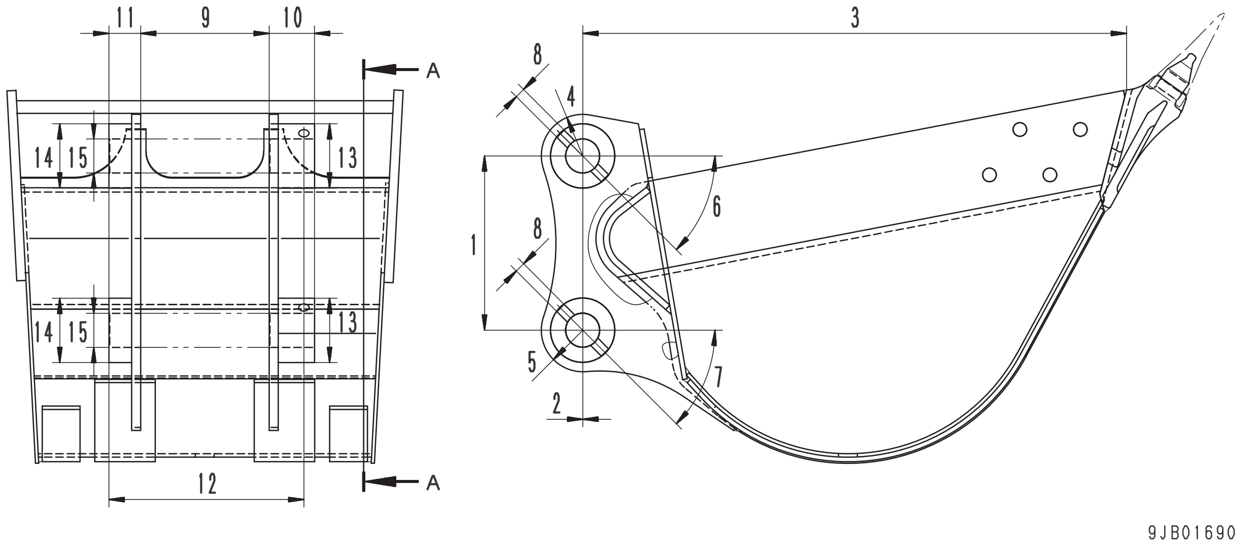
PC35MR-2



Unit: mm

No.	PC35MR-2		
	Measuring point	Standard size	Tolerance
1	—	194.6	± 0.5
2	—	0	—
3	—	609.5	—
4	—	50	—
5	—	50	—
6	—	45°	—
7	—	45°	—
8	—	ø 13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	ø 60	—
14	—	ø 60	—
15	—	ø 35	0 – 0.040

PC40MR, 50MR-2



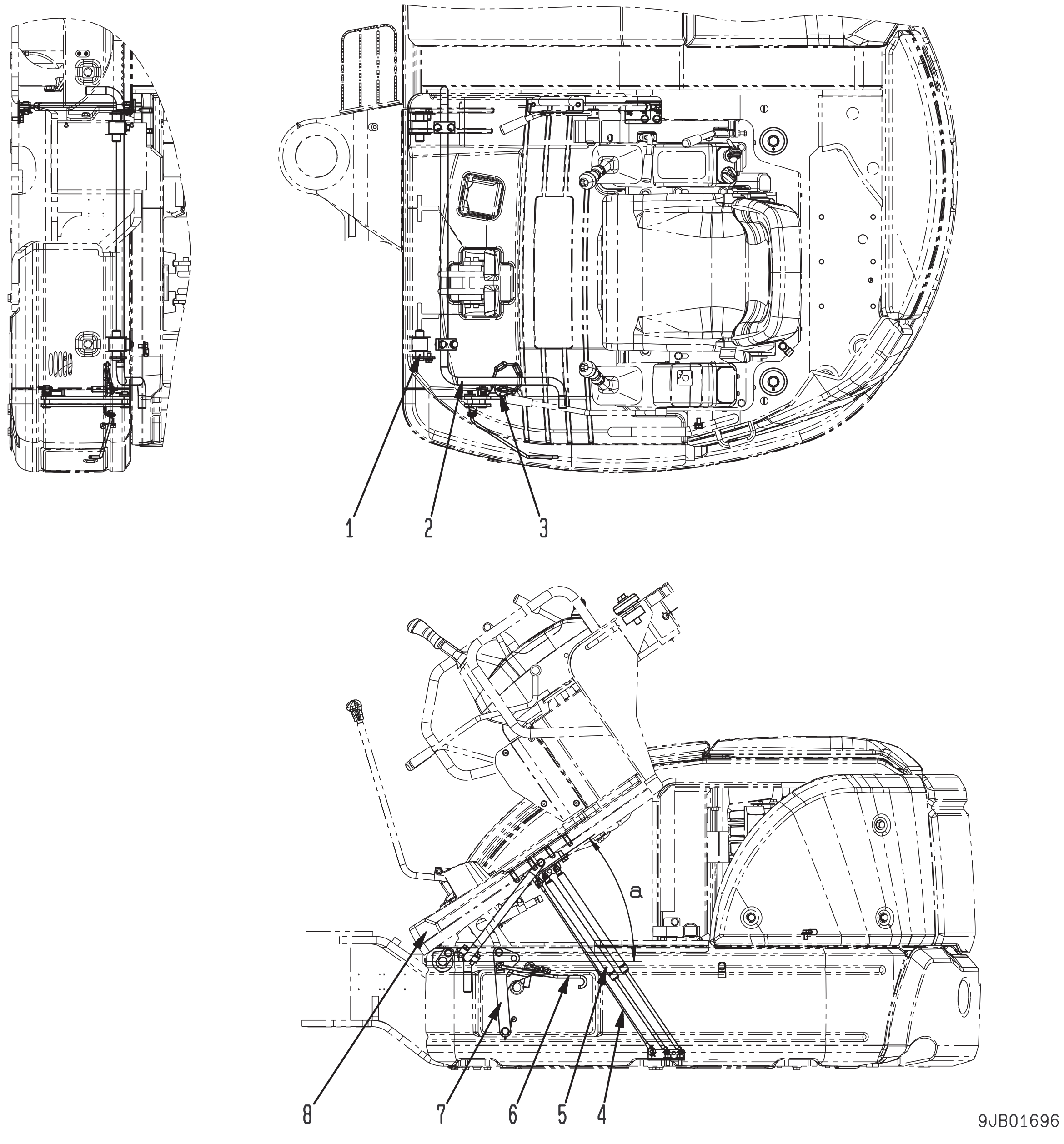
Unit: mm

No.	PC40MR, 50MR-2		
	Measuring point	Standard size	Tolerance
1	—	230.3	± 0.5
2	—	0	—
3	—	719.6	—
4	—	55	—
5	—	55	—
6	—	45°	—
7	—	45°	—
8	—	ø 13.5	—
9	—	170	± 1
10	—	60	—
11	—	42	—
12	—	258	± 1
13	—	ø 85	—
14	—	ø 85	—
15	—	ø 45	– 0.050 – 0.089

FLOOR

TILT FLOOR

★ The following figure shows PC40MR with the canopy specification.
(Except PC35MR-2 with the canopy specification, Serial No. 9242 and up for North America.)

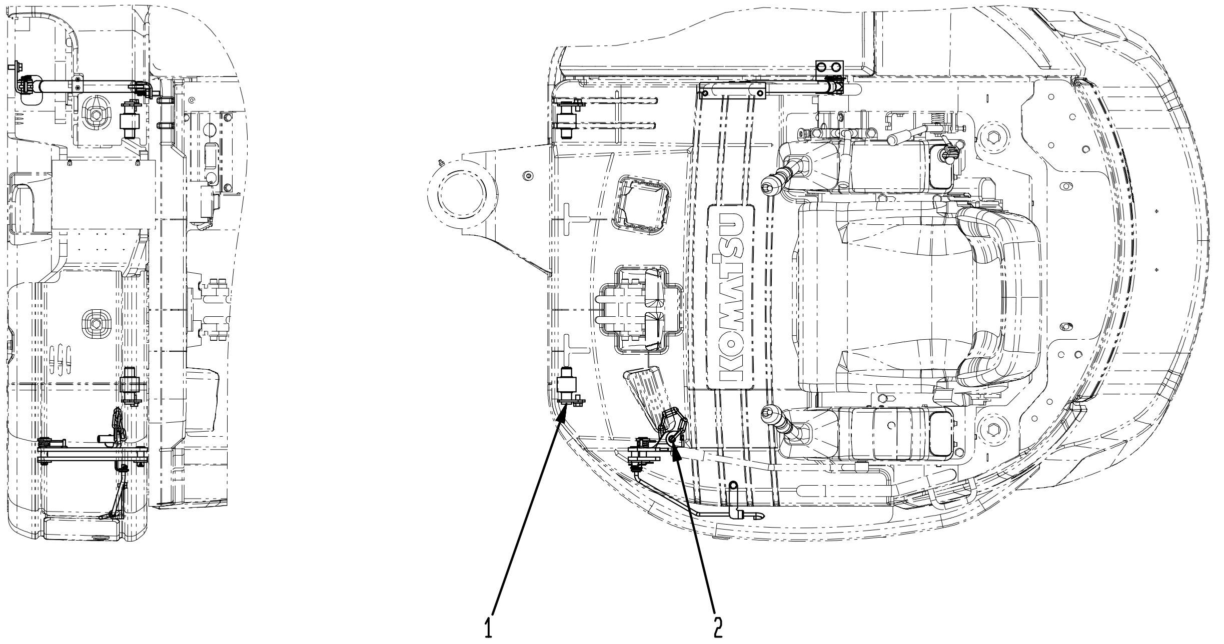


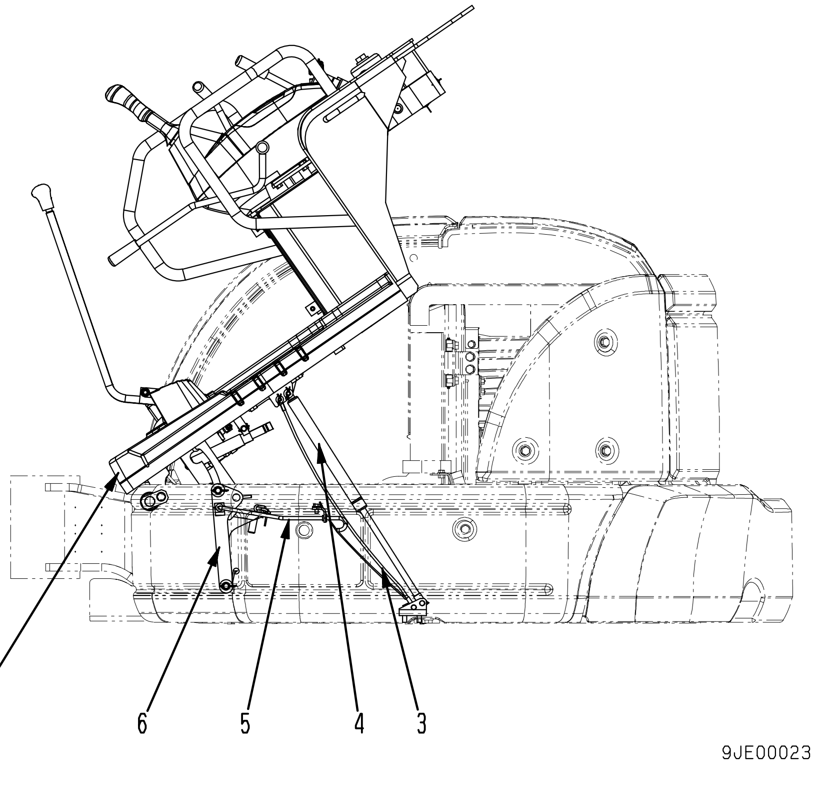
1. Hinge pin
2. Torsion bar
3. Lock pin
4. Wire
5. Gas spring
6. Reset lever
7. Tilt lock bracket
8. Floor assembly

OUTLINE

- The tilt floor can be tilted open for the ease of adjusting of the fan belt, inspection and maintenance such as replacement of the hydraulic hoses, etc.
  Tilt open angle **a**: Approx. 35°

PC35MR-2 with the canopy specification.
Serial No. 9242 and up for North America.





1. Hinge pin
2. Lock pin
3. Wire
4. Gas spring
5. Reset lever
6. Tilt lock bracket
7. Floor assembly

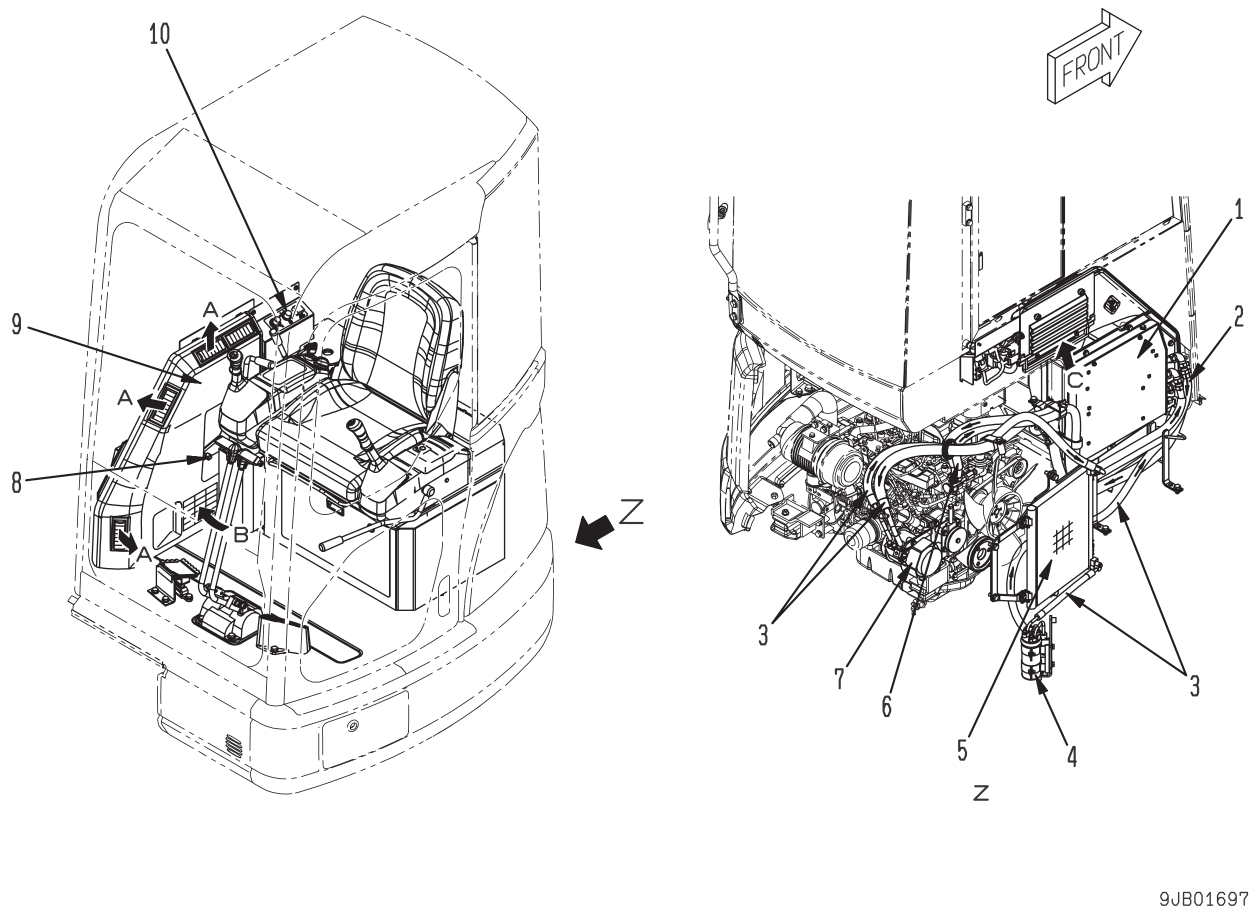
OUTLINE

- The tilt floor can be tilted open for the ease of adjusting of the fan belt, inspection and maintenance such as replacement of the hydraulic hoses, etc.
  Tilt open angle **a**: Approx. 35°

AIR CONDITIONER

AIR CONDITIONER PIPING

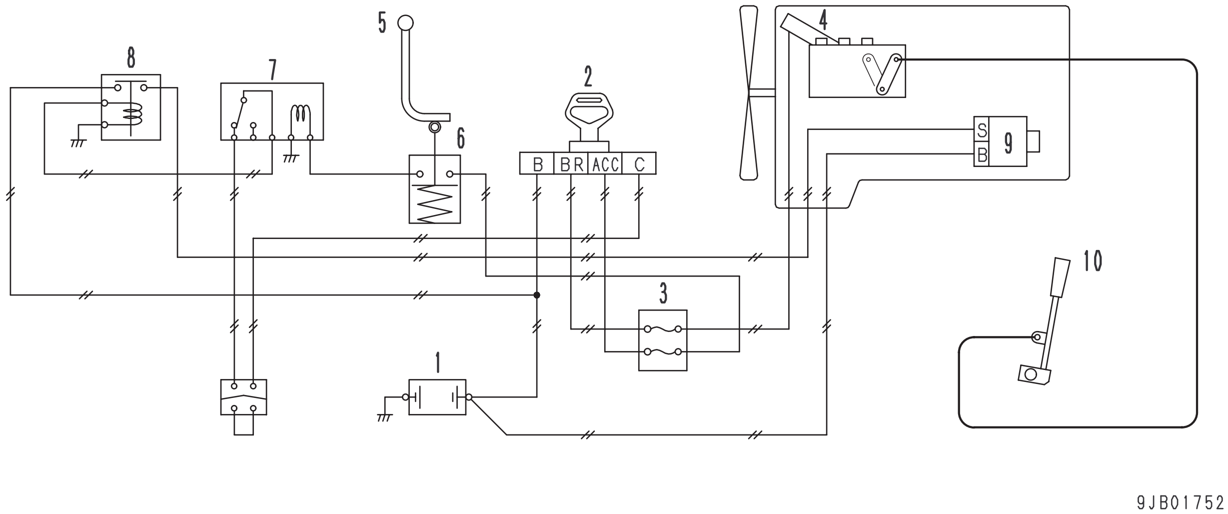
★ This diagram shows PC40MR, 50MR.



A: Hot/Cold air outlet
B: Inside air circulation opening
C: Fresh air intake opening

1. Air conditioner unit
2. Return hot water piping
3. Refrigerant piping
4. Receiver drier
5. Condenser
6. Hot water take-off piping
7. Air conditioner compressor
8. Inside/Fresh air selector lever
9. Duct
10. Control panel assembly

ENGINE CONTROL



1. Battery
2. Starting switch
3. Fuse box
4. Engine stop solenoid
5. Lock lever
6. PPC lock switch
7. Neutral-engine start relay
8. Safety relay
9. Starting motor
10. Fuel control lever

Starting engine

- If starting switch (2) is set to the ON position, engine stop solenoid (4) sets the governor stop lever to the RUN position. Accordingly, if the electric system has a failure, the engine stops, that is, a fail-safe mechanism is formed.
- If starting switch (2) is set to the START position while lock lever (5) is in the LOCK position, the start signal flows in starting motor (9) and the engine starts. If lock lever (5) is in the FREE position, neutral-engine start relay (7) operates to shut off the start signal to starting motor (9), thus the engine does not start.

Engine speed control

- If fuel control lever (10) is operated, the cable is extended or retracted to control the engine speed.

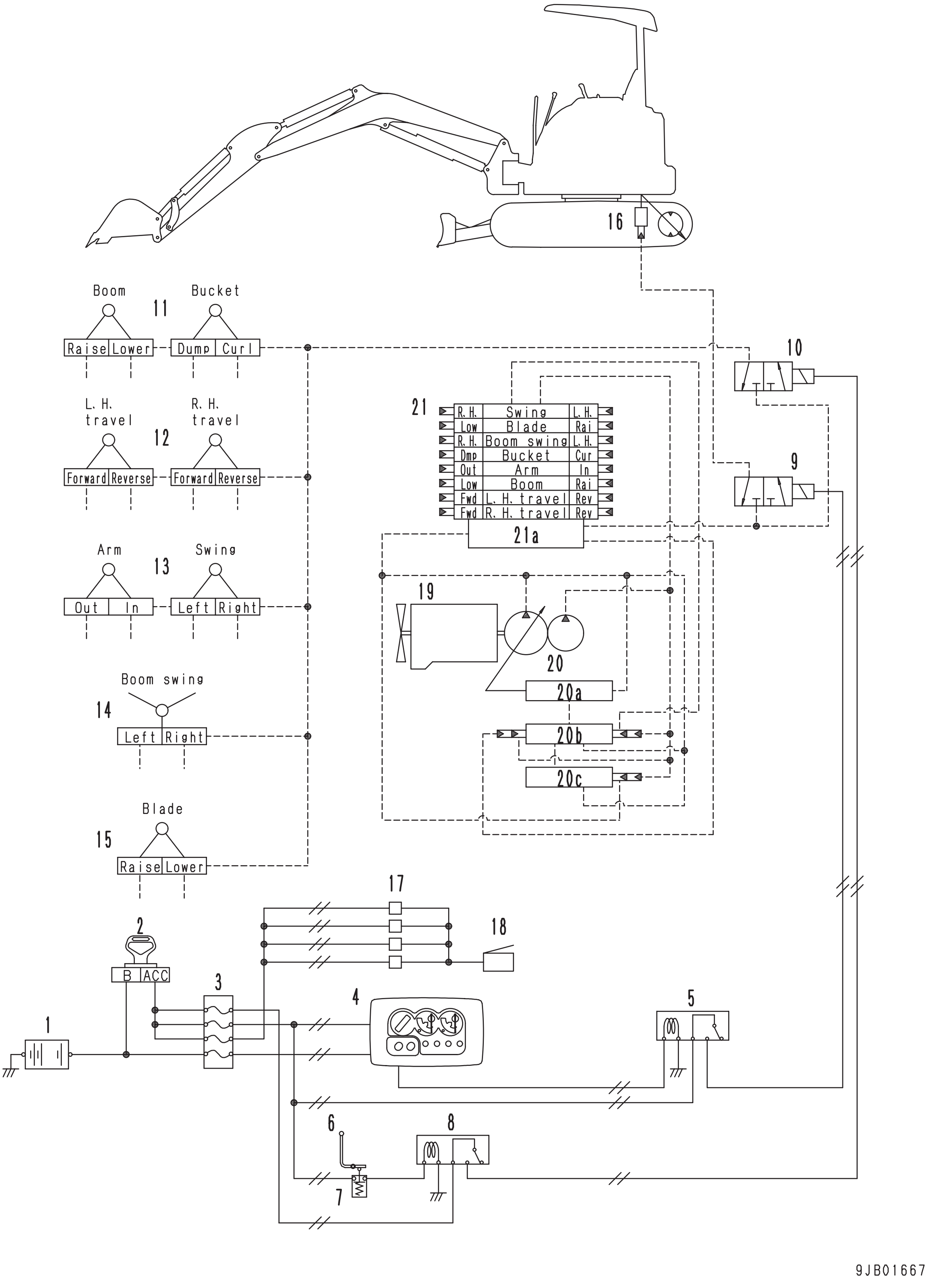
Stopping engine

- If starting switch (2) is set in the OFF position, engine stop solenoid (4) sets the governor stop lever in the STOP position to stop the engine.

ELECTRIC CONTROL SYSTEM

GENERAL SYSTEM DRAWING

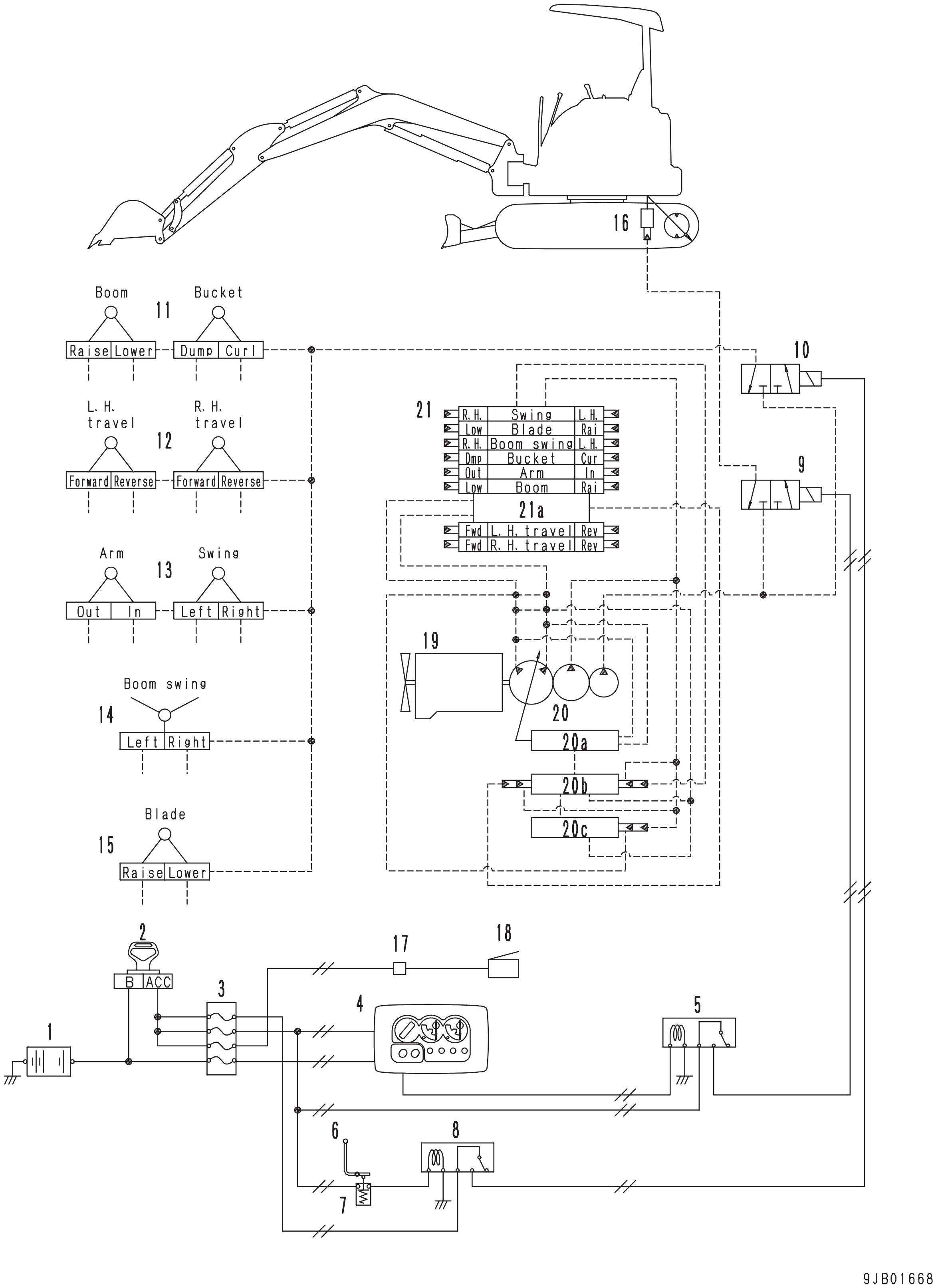
PC27MR, 30MR-2



1. Battery
2. Starting switch
3. Fuse box
4. Monitor panel
5. 2nd travel speed selection solenoid relay
6. Lock lever
7. PPC lock switch
8. PPC lock solenoid relay
9. 2nd travel speed selection solenoid valve
10. PPC lock solenoid valve
11. Right work equipment PPC valve
12. Travel PPC valve
13. Left work equipment PPC valve
14. Boom swing PPC valve
15. Blade PPC valve
16. Travel motor
17. Travel pressure switch
18. Travel alarm
19. Engine
20. Hydraulic pump

20a. Servo valve
20b. LS valve
20c. PC valve
21. Control valve
21a. Self-reducing pressure valve

PC35MR, 40MR, 50MR-2



1. Battery
2. Starting switch
3. Fuse box
4. Monitor panel
5. 2nd travel speed selection solenoid relay
6. Lock lever
7. PPC lock switch
8. PPC lock solenoid relay
9. 2nd travel speed selection solenoid valve
10. PPC lock solenoid valve
11. Right work equipment PPC valve
12. Travel PPC valve
13. Left work equipment PPC valve
14. Boom swing PPC valve
15. Blade PPC valve
16. Travel motor
17. Travel pressure switch
18. Travel alarm
19. Engine
20. Hydraulic pump

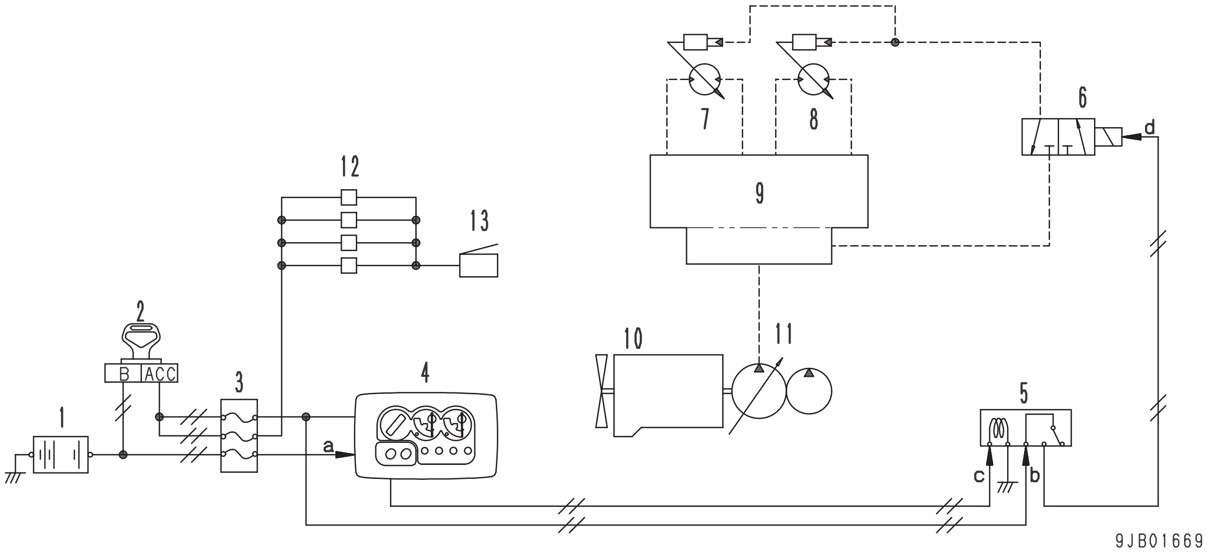
20a. Servo valve
20b. LS valve
20c. PC valve

21. Control valve

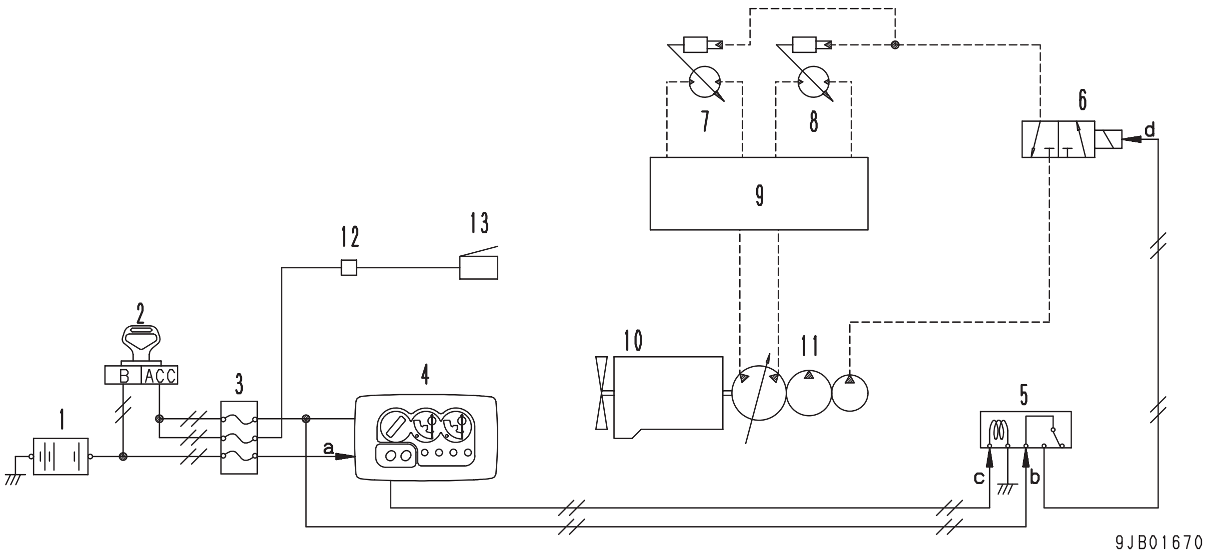
21a. Pump merge-divider valve

TRAVEL CONTROL FUNCTION

PC27MR, 30MR-2



PC35MR, 40MR, 50MR-2



1. Battery
2. Starting switch
3. Fuse box
4. Monitor panel
5. 2nd travel speed selection solenoid relay
6. 2nd travel speed selection solenoid valve
7. Left travel motor
8. Right travel motor
9. Control valve
10. Engine
11. Hydraulic pump
12. Travel pressure switch
13. Travel alarm

Input and output signals

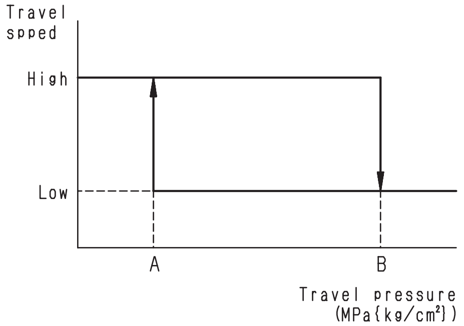
a. Monitor panel power supply
b. Solenoid power supply
c. 2nd travel speed selection signal
d. Solenoid valve drive signal

FUNCTION

Changing travel speed

- If the travel speed selector switch of the monitor panel is operated, the motor capacity changes, thus the travel speed changes.

★ Even while the machine is traveling at the high speed (High), if the load changes largely on a soft ground or on a slope, the travel speed is set to the low speed (Low) automatically. At this time, the 2nd travel speed selection monitor keeps lighting up.



9JB01671

	PC27MR-2 PC30MR-2 PC35MR-2	PC40MR-2 PC50MR-2
A	19.8 MPa {202 kg/cm^2}	12.7 MPa {130 kg/cm^2}
B	21.3 MPa {217 kg/cm^2}	23.5 MPa {240 kg/cm^2}

PC27MR, 30MR, 35MR-2

2nd travel speed selection switch	Low speed	High speed
2nd travel speed selection monitor	OFF	ON
2nd travel speed selection solenoid valve	OFF	ON
Motor capacity (cm^3/rev)	22.1	12.2
Travel speed (km/h)	2.6 (2.8)	4.6
Travel motor swash plate angle	Max.	Min.

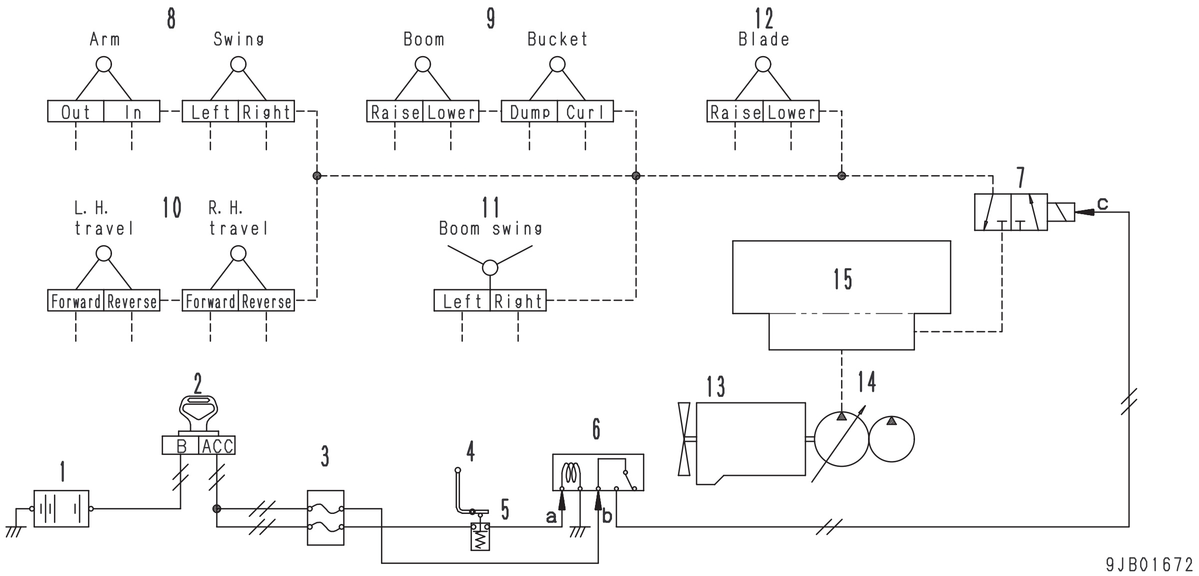
The values in ( ) are for PC35MR-2.

PC40MR, 50MR-2

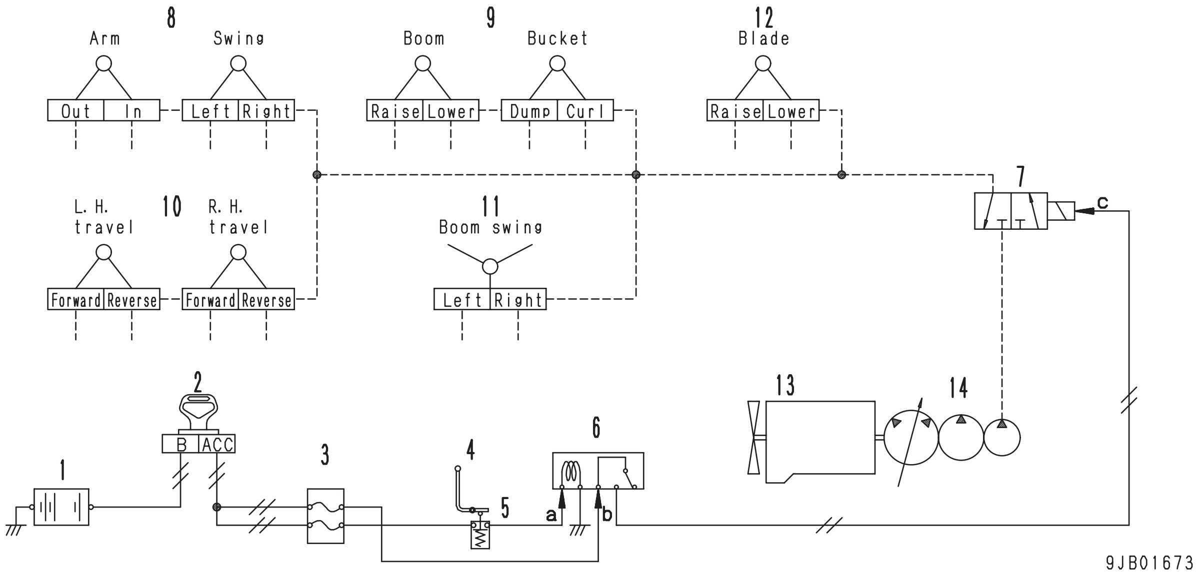
2nd travel speed selection switch	Low speed	High speed
2nd travel speed selection monitor	OFF	ON
2nd travel speed selection solenoid valve	OFF	ON
Motor capacity (cm^3/rev)	33.08	19.11
Travel speed (km/h)	2.8	4.6
Travel motor swash plate angle	Max.	Min.

PPC LOCK FUNCTION

PC27MR, 30MR-2



PC35MR, 40MR, 50MR-2



1. Battery
2. Starting switch
3. Fuse box
4. Lock lever
5. PPC lock lever
6. PPC lock solenoid relay
7. PPC lock solenoid valve
8. Left PPC valve
9. Right PPC valve
10. Travel PPC valve
11. Boom swing PPC valve
12. Blade PPC valve
13. Engine
14. Hydraulic pump
15. Control valve

Input and output signals

a. PPC lock signal
b. Solenoid power supply
c. Solenoid valve drive signal

FUNCTION

- The PPC lock switch is interlocked with the lock lever. If the lock lever is set in the LOCK position, the PPC lock switch is turned OFF.
- If the PPC lock switch is turned OFF, the current flowing to the PPC lock solenoid valve is shut off. Then, the work equipment and machine unit do not move even if any control lever or pedal is operated.

COMPONENT PARTS OF SYSTEM

PPC LOCK SOLENOID VALVE

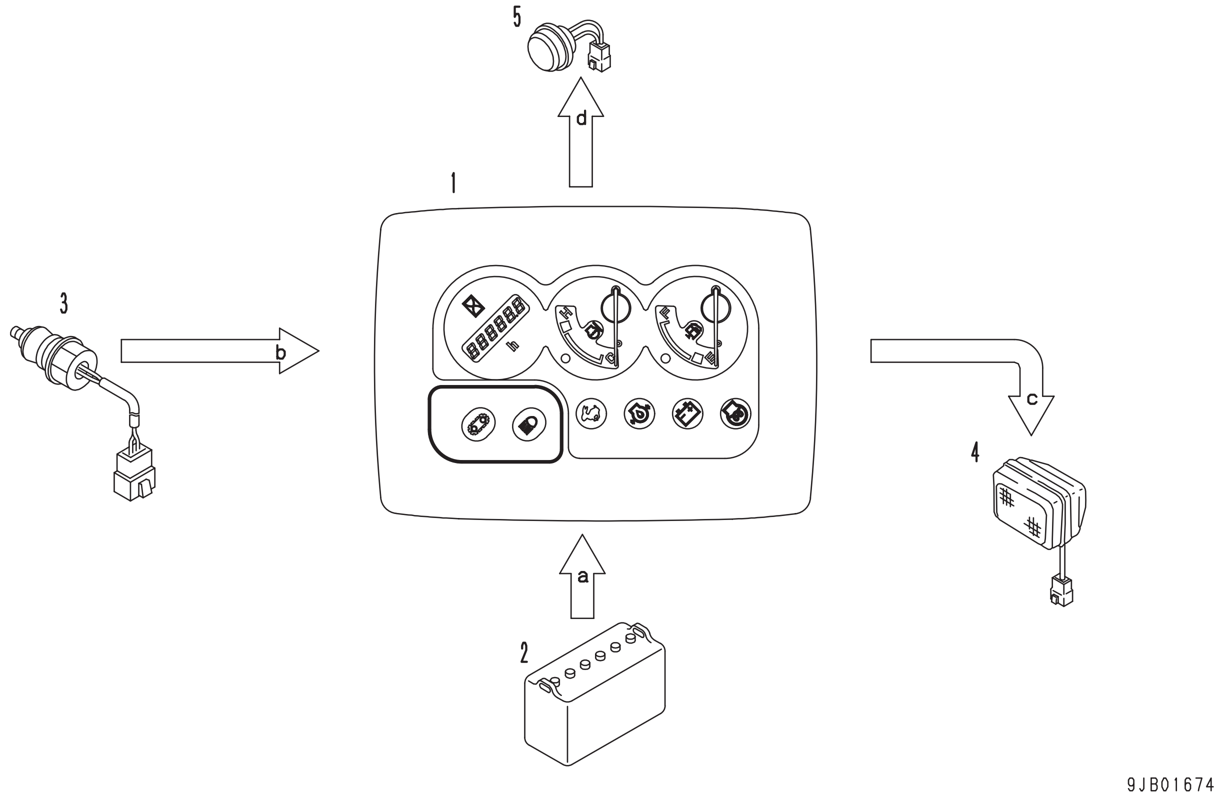
2ND TRAVEL SPEED SELECTION SOLENOID VALVE

★ See SOLENOID VALVE.

MONITOR PANEL

★ See MONITOR SYSTEM.

MONITOR SYSTEM

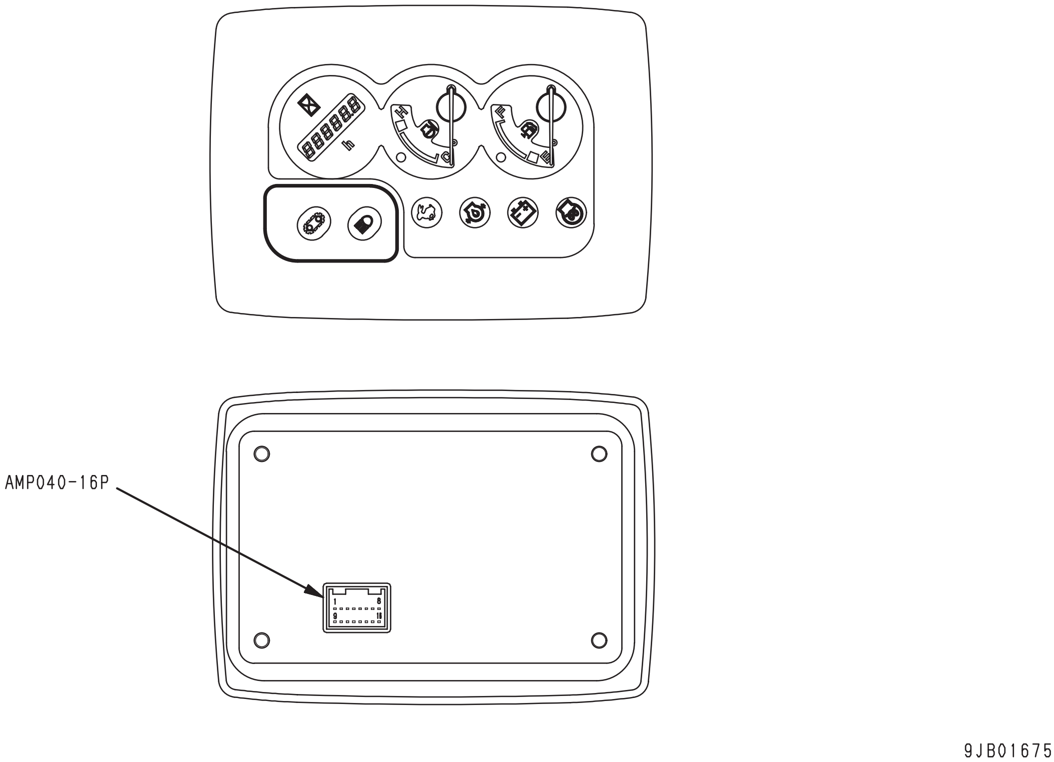


1. Monitor panel
2. Battery
3. Each sensor
4. Working lamp
5. Alarm buzzer

Input and output signals
a. Power supply
b. Sensor signal
c. Switch signal
d. Alarm buzzer signal

OUTLINE
- The machine monitor system uses the net work circuit between the controllers and sensor installed to all parts of the machine to observe the condition of the machine. It processes this information, and display it on a panel to inform the operator of condition of the machine.

MONITOR PANEL



OUTLINE

- The monitor panel has the monitor display function, gauge display function, and service meter function.
- The monitor switch section consists of 2 flat-type sheet switches. Each time either switch is pressed, the machine condition changes.
- There is a CPU (Center Processing Unit) in the monitor panel to process, display, and output the information.
- If the monitor panel has a failure, it does not display normally.

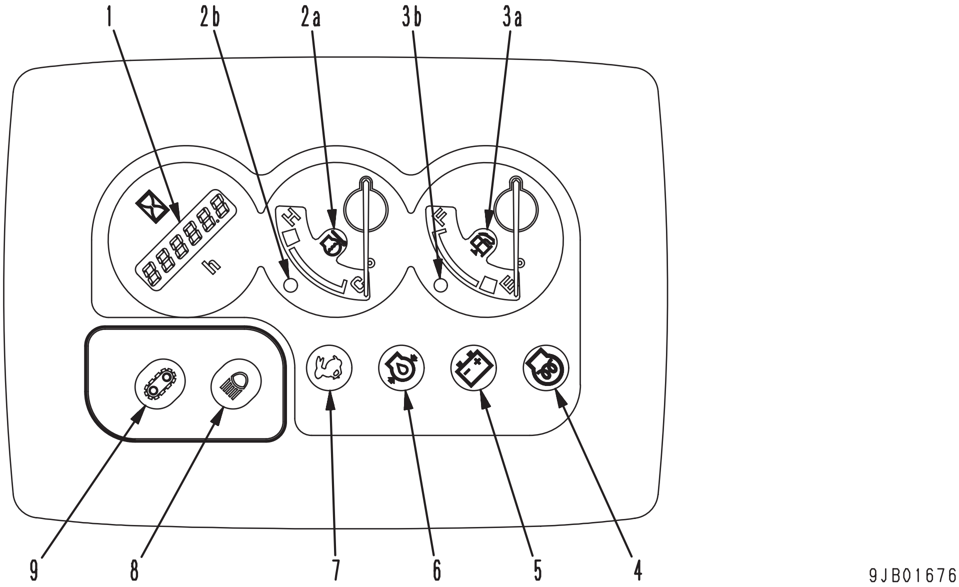
Input and output signals

AMP040-16P [CN-F15]

Pin No.	Signal name	Input/Output signal
1	Service power supply (12 V)	–
2	ACC power supply	–
3	NC	–
4	GND	–
5	Charge level	Input
6	Coolant temperature (+)	Input
7	Fuel level	Input
8	Working lamp relay	Output

Pin No.	Signal name	Input/Output signal
9	NC	–
10	Alarm buzzer	Output
11	Coolant temperature (-)	Input
12	Engine start	Input
13	Preheating	Input
14	Engine oil pressure	Input
15	NC	–
16	2nd travel speed selection solenoid relay	Output

OPERATION



Gauge and monitor display section

No.	Category of display	Displayed item	Display range	Display method	Display color	Remarks
1	Service meter		0 – 99999.9 h	Time is measured while engine is running (while alternator is generating).	Blue	LCD
2a	Gauge	Coolant temperature	See above figure.	Pointer indicates corresponding position. (If pointer enters red range, caution lamp flashes and alarm buzzer sounds.)	—	—
2b	Caution		Above set temperature 105°C		Amber	LED
3a	Gauge	Fuel level	See above figure.	Pointer indicates corresponding position. (If pointer enters red range, caution lamp flashes.)	—	—
3b	Caution		Below set level 4.5 ℓ (*1) 14.0 ℓ (*2)		Amber	LED
4	Pilot	Preheating	During preheating time	When starting switch is set in HEAT position, lamp flashes and alarm buzzer sounds to notify completion of preheating, and then lamp goes off. (Preheating time: Approx. 18 sec)	Green	
5	Caution	Charge level	When charging is abnormal (charge voltage < battery voltage)	Lamp lights up when starting switch is set to ON position and goes off after engine starts. If condition is normal, lamp goes off. If condition is abnormal, lamp flashes. (If condition becomes abnormal while engine is running, alarm buzzer sounds.)	Red	
6		Engine oil pressure	Below set pressure 49 kPa {0.5 kg/cm^2}			
7	Pilot	2nd travel speed selection	When 2nd travel speed is selected	Lamp lights up while travel speed selector switch is turned ON. (While lamp is lighting up, travel speed can be increased (automatically)).	Orange	

*1: PC30MR, 35MR-2, *2: PC40MR, 50MR-2

Switch section

No.	Name	Function	Operation
8	Lamp switch	Used to turn on working lamp and monitor illumination. OFF : Lamps go off. ON : Lamps light up.	OFF ⟷ ON (Lamp is OFF) (Lamp is ON)
9	Travel speed selector switch	Used to set travel speed to low or high. OFF : Travel speed is low and 2nd travel speed selection pilot lamp goes off. ON : Travel speed is set high (automatically) and 2nd travel speed selection pilot lamp lights up. <When arm crane is used, travel speed is set low.>	**OFF** ⟷ ON (Low speed) (High speed)

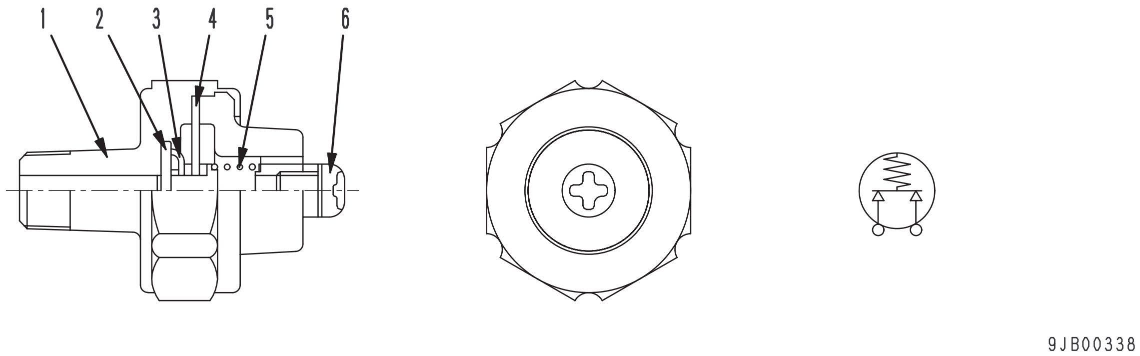
★ The bold letters in the OPERATION column show the switch position in which the switch is reset when the starting switch is turned from OFF position to ON position.

SENSORS

- The signal from each sensor is input to the panel directly.
- The sensors are classified into contact type and resistance type.
- Either side of a sensor of contact type is always connected to the chassis ground.

Category of display	Name of sensor	Type of sensor	When normal	When abnormal
Caution	Engine oil pressure	Contact	OFF (Open)	ON (Closed)
Gauge	Coolant temperature	Resistance	—	—
	Fuel level	Resistance	—	—

ENGINE OIL PRESSURE SENSOR

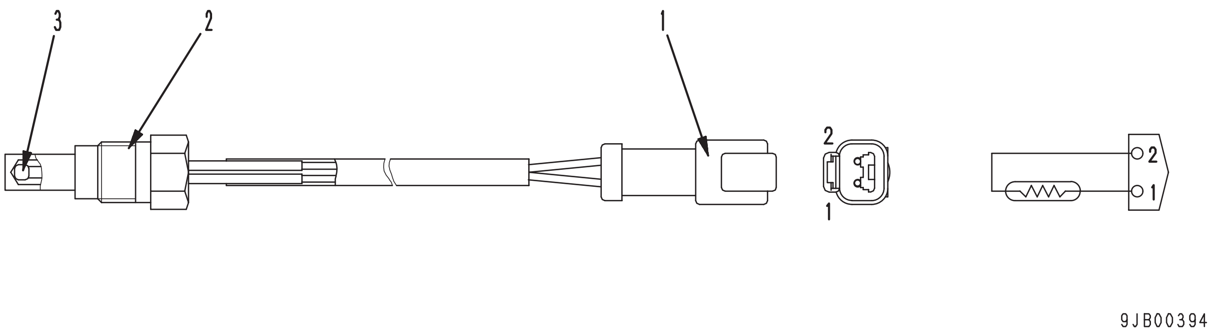


1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

FUNCTION

- The engine oil pressure sensor is installed to the engine cylinder block and its diaphragm senses oil pressure. If the oil pressure lowers below the set level, the switch is turned ON.

COOLANT TEMPERATURE SENSOR

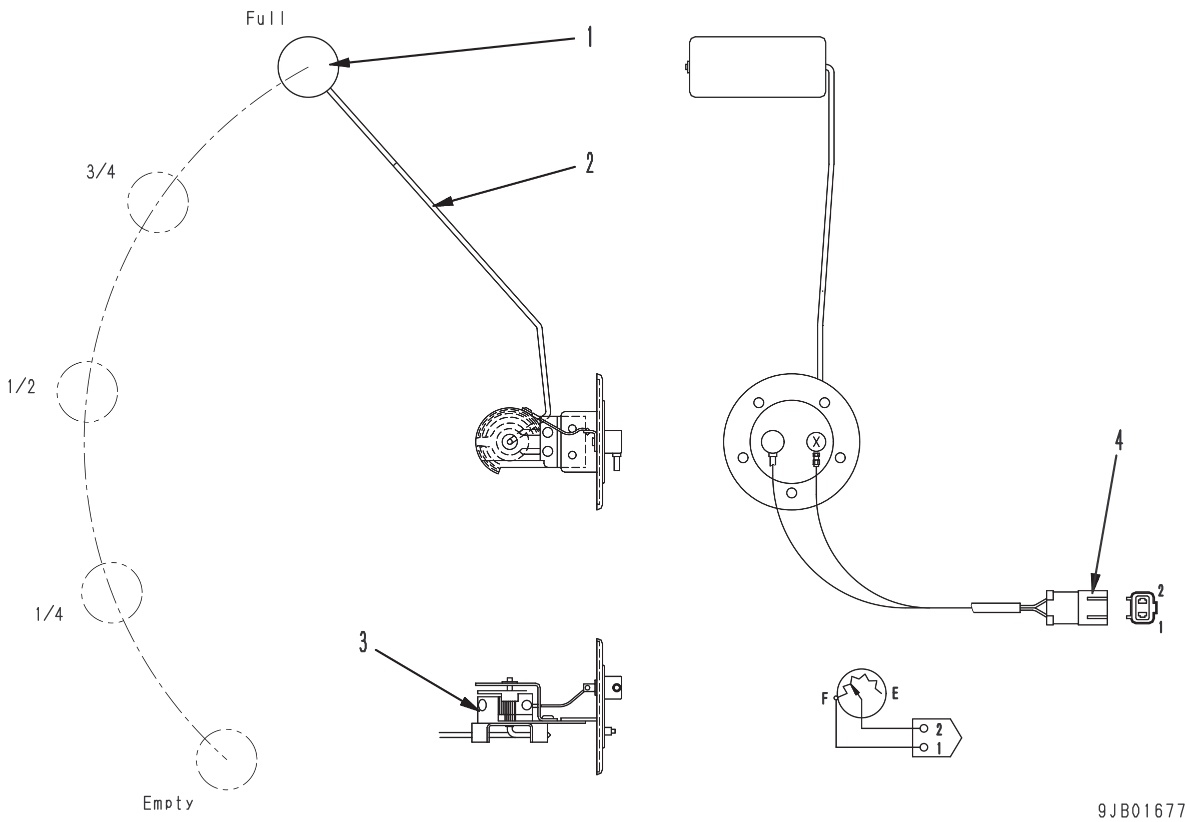


1. Connector
2. Plug
3. Thermistor

FUNCTION

- The coolant temperature sensor is installed to the engine cylinder block. It senses changes of temperature as changes of resistance of the thermistor in it, and then generates signals according the measured temperature.

FUEL LEVEL SENSOR



1. Float
2. Arm
3. Variable resistor
4. Connector

FUNCTION

- The fuel level sensor is installed to the side of the fuel tank and its float moves up and down according to the fuel level in the tank. The movement of the float operates the variable resistor through the arm, and then signals are generated according to the change of the resistance.

20 TESTING AND ADJUSTING

STANDARD VALUE TABLE FOR ENGINE RELATED PARTS 20-2
STANDARD VALUE TABLE FOR CHASSIS RELATED PARTS .. 20-5
TESTING AND ADJUSTING 20-101
TROUBLESHOOTING.. 20-201

★ Note the following when making judgements using the standard value tables for testing, adjusting, or troubleshooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims.

⚠ When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, inset the safety pins, and use blocks to prevent the machine from moving.

⚠ When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

⚠ When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.

⚠ Be careful not to get caught in the fan, fan belt or other rotating parts.

STANDARD VALUE TABLE FOR ENGINE RELATED PARTS

Applicable model			PC27MR-2	
Engine			3D82AE-5M	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,780 ± 25	—
	Low idle		$1,250^{+50}_{0}$	—
	Rated speed		2,600	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.0	5.5
	At high idle		Max. 1.0	2.0
Valve clearance (Normal temperature)	Intake valve	mm	0.20	—
	Exhaust valve		0.20	—
Compression pressure	Oil temperature: 40 – 60ºC Engine speed: 250rpm	MPa {kg/cm^2}	3.16 {32}	2.45 {25}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH_2O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm^2}	0.29 – 0.39 {3.0 – 4.0}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	ºC	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	16	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	7 – 12	—

Applicable model			PC30MR-2	
Engine			3D84E-5N	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,700 ± 50	—
	Low idle		1,250 ± 50	—
	Rated speed		2,500	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.0	5.5
	At high idle		Max. 1.0	2.0
Valve clearance (Normal temperature)	Intake valve	mm	0.20	—
	Exhaust valve		0.20	—
Compression pressure	Oil temperature: 40 – 60ºC Engine speed: 250rpm	MPa {kg/cm^2}	3.24 {33}	2.55 {26}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH_2O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm^2}	0.29 – 0.39 {3.0 – 4.0}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	ºC	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	15	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	9 – 13	—

Applicable model			PC35MR-2	
Engine			3D88E-5P	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,590 ± 50	—
	Low idle		1,250 ± 50	—
	Rated speed		2,400	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.0	5.5
	At high idle		Max. 1.5	2.0
Valve clearance (Normal temperature)	Intake valve	mm	0.20	—
	Exhaust valve		0.20	—
Compression pressure	Oil temperature: 40 – 60ºC Engine speed: 250rpm	MPa {kg/cm^2}	3.43 {35}	2.75 {28}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH_2O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm^2}	0.29 – 0.39 {3.0 – 4.0}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	ºC	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	14	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	9 – 13	—

Applicable model			PC35MR-2 (High altitude spec. S/No. 6736 and up)	
Engine			S3D84E-5PBA	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,950 ± 50	—
	Low idle		1,250 ± 50	—
	Rated speed		2,400	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.5	5.5
	At high idle		Max. 1.0	2.0
Valve clearance (Normal temperature)	Intake valve	mm	0.20	—
	Exhaust valve		0.20	—
Compression pressure	Oil temperature: 40 – 60ºC Engine speed: 250rpm	MPa {kg/cm^2}	2.94 {30}	2.45 {25}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH$_2$O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm^2}	0.39 – 0.49 {4.0 – 5.0}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	ºC	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	15	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	9 – 13	—

Applicable model			PC40, 50MR-2	
Engine			4D88E-5X	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,500 ± 50	—
	Low idle		1,175 ± 50	—
	Rated speed		2,350	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.0	5.5
	At high idle		Max. 1.0	2.0
Valve clearance (Normal temperature)	Intake valve	mm	0.20	—
	Exhaust valve		0.20	—
Compression pressure	Oil temperature: 40 – 60ºC Engine speed: 250rpm	MPa {kg/cm^2}	3.24 {33}	2.55 {26}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH$_2$O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm^2}	0.39 – 0.49 {4.0 – 5.0}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	ºC	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	15.5	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	9 – 13	—

STANDARD VALUE TABLE FOR CHASSIS RELATED PARTS

<table>
<tr><th colspan="5">Machine model</th><th colspan="2">PC27MR-2</th></tr>
<tr><th>Category</th><th>Item</th><th colspan="2">Measurement conditions</th><th>Unit</th><th>Standard value for new machine</th><th>Service limit value</th></tr>
<tr><td rowspan="2">Engine speed</td><td>Speed when 1 pump is relieved</td><td colspan="2" rowspan="2">• Hydraulic oil temperature: 45 – 55°C
• Engine oil pressure: Within operating range
• Engine coolant temperature: Within operating range
• Relief of 1 pump: Relieve bucket circuit.
• Relief of 2 pumps: Relieve bucket and swing circuits.</td><td rowspan="2">rpm</td><td>Min. 2,300</td><td>Min. 2,300</td></tr>
<tr><td>Speed when 2 pumps are relieved</td><td>Min. 2,100</td><td>Min. 2,100</td></tr>
<tr><td rowspan="9">Stroke of control valve spool</td><td>Boom control valve</td><td colspan="2" rowspan="9">★For details, see Fig. A at the end of this section.</td><td rowspan="9">mm</td><td rowspan="9">ℓ = 30
a = 6
b = 6</td><td rowspan="9">ℓ = 30
a = 6
b = 6</td></tr>
<tr><td>Arm control valve</td></tr>
<tr><td>Bucket control valve</td></tr>
<tr><td>Swing control valve</td></tr>
<tr><td>Breaker control valve</td></tr>
<tr><td>Boom swing control valve</td></tr>
<tr><td>Blade control valve</td></tr>
<tr><td>Left travel control valve</td></tr>
<tr><td>Right travel control valve</td></tr>
<tr><td rowspan="10">Stroke of control lever and pedal</td><td>Boom control lever</td><td rowspan="10">• Stop engine.
• Measure at center of lever grip.
• Measure at pedal tip.
• Read max. value to stroke end (excluding neutral play).</td><td>N → RAISE, LOWER</td><td rowspan="10">mm</td><td>80 ± 10</td><td>80 ± 10</td></tr>
<tr><td>Arm control lever</td><td>N → IN, OUT</td><td>80 ± 10</td><td>80 ± 10</td></tr>
<tr><td>Bucket control lever</td><td>N → CURL, DUMP</td><td>80 ± 10</td><td>80 ± 10</td></tr>
<tr><td>Swing control lever</td><td>N → Swing to LEFT, RIGHT</td><td>80 ± 10</td><td>80 ± 10</td></tr>
<tr><td>Boom swing control pedal</td><td>N → Swing boom to LEFT, RIGHT</td><td>25 ± 5</td><td>25 ± 5</td></tr>
<tr><td>Blade control lever</td><td>N → RAISE, LOWER</td><td>50 ± 5</td><td>50 ± 5</td></tr>
<tr><td>Travel control lever</td><td>N → FORWARD, REVERSE</td><td>100 ± 10</td><td>100 ± 10</td></tr>
<tr><td>Fuel control lever</td><td>SLOW ↔ FULL THROTTLE</td><td>160 ± 20</td><td>160 ± 20</td></tr>
<tr><td rowspan="2">Play of control lever</td><td>Work equipment, swing</td><td>Max. 5</td><td>Max. 5</td></tr>
<tr><td>Travel</td><td>Max. 5</td><td>Max. 5</td></tr>
</table>

Machine model					PC27MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Operating effort of control levers and pedals	Boom control lever	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Install push-pull scale to center of lever grip or pedal tip to measure. • Read max. value to stroke end.		N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Arm control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Bucket control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Swing control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Boom swing control pedal				78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}
	Blade control lever				29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}
	Travel control lever				19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}
	Fuel control lever		Idle → Full throttle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
			Full throttle → Idle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
Oil pressure	Unload pressure	• Hydraulic oil temperature: 45 – 55°C • Set all levers in neutral. • Run engine at full throttle. • Measure pump outlet pressure.		MPa {kg/cm²} Target value (Range)	$3.9^{+0.98}_{0}$ $\{39.6^{+10}_{0}\}$	$3.9^{+0.98}_{0}$ $\{39.6^{+10}_{0}\}$
	Boom relief pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle and measure relief pressure (Relieve only circuit to be measured). • Measure pump outlet pressure.			$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$	$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$
	Arm relief pressure				$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$	$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$
	Bucket relief pressure				$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$	$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$
	Swing relief pressure				18.1 ± 0.98 {185 ± 10}	18.1 ± 0.98 {185 ± 10}
	Boom swing relief pressure				$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$	$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$
	Blade relief pressure		Raise		20.6 ± 0.98 {210 ± 10}	20.6 ± 0.98 {210 ± 10}
			Lower		20.6 ± 0.98 {210 ± 10}	20.6 ± 0.98 {210 ± 10}
	Travel relief pressure				$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$	$24.5^{+0.98}_{-0.49}$ $\{250^{+10}_{-5}\}$
	Control circuit oil pressure (Oil pressure lowered by self pressure)	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Measure circuit oil pressure when all control levers are in neutral. • Measure pump outlet pressure.			$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$	$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$

Machine model					PC27MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Pump outlet pressure - LS pressure	When all levers are in neutral	MPa {kg/cm²} Target value (Range)	$3.9^{+0.98}_{0}$ $\{39.6^{+10}_{0}\}$	$3.9^{+0.98}_{0}$ $\{39.6^{+10}_{0}\}$
			While bucket is curled with no load (full throttle)		1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}
Swing	Overrun of swing	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Stop after swinging 1 turn and measure shifting distance of swing circle. • Value in ( ) is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to pass 90-degree and 180-degree points after starting swinging.	90 deg.	sec	2.1 ± 0.3	2.8
			180 deg.		—	—
	Time required for swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to swing 5 turns after swinging 1 turn.			32 ± 3	37
	Hydraulic drift of swing	★For measuring posture, see Fig. C at end of this section. • Max. reach • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Fill bucket with rated load or dirt and sand. (Rated load: 1,422 N {145 kg}) • Stop machine on slope of 15 degrees and set its upper structure at 45 degrees upward. • Make match marks on swing circle outer race and track frame. • Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Relieve swing circuit and measure leakage in 1 minute.		cc/min	—	—
Travel	Travel speed	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on flat ground, measure time required to travel 20 m. • ( ): Machine with steel shoe specification	Low speed	sec	27.7 ± 2 (26.9 ± 2)	27.7 ± 4 (26.9 ± 4)
			High speed		15.7 ± 2 (15.3 ± 2)	15.7 ± 4 (15.3 ± 4)
	Travel deviation	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on hard and flat ground, measure travel deviation X in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 500	550
			High speed		Max. 500	550

Machine model					PC27MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Hydraulic drift of travel	★For measuring posture, see Fig. F at end of this section. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Stop machine on slope of 30 degrees with sprocket on upper side. • Measure hydraulic drift of travel in 5 minutes.		mm	0	0
Travel	Leakage from travel motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Lock shoe to relieve travel circuit.		ℓ/min	—	—
Work equipment / Hydraulic drift	Whole work equipment (Hydraulic drift of bucket tooth tip)	★For measuring posture, see Fig. G at end of this section. • Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position. • Stop machine on level and flat ground. • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set lever in neutral. • Stop engine • Hydraulic oil temperature: 45 – 55°C • Start measurement just after setting. • Measure hydraulic drift every 5 minutes for 15 minutes.		mm	Max. 300	450
	Boom cylinder (Retraction of cylinder)				Max. 20	30
	Arm cylinder (Extension of cylinder)				Max. 20	30
	Bucket cylinder (Retraction of cylinder)				Max. 20	30
	Boom swing cylinder (Retraction and extension of cylinder)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set machine in above position on slope of 15 degrees with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.			Max. 20	30
	Blade (Hydraulic drift of blade tip)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Measure hydraulic drift of blade tip from maximum raising height for 15 minutes.			Max. 30	45
Work equipment / Work equipment speed	Boom speed	★For measuring posture, see Fig. H at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground.	RAISE	sec	2.4 ± 0.3	3.0
			LOWER		2.4 ± 0.3	3.0
	Arm speed	★For measuring posture, see Fig. I at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	IN		2.8 ± 0.3	3.4
			OUT		2.5 ± 0.3	3.1
	Bucket speed	★For measuring posture, see Fig. J at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	CURL		2.4 ± 0.3	3.0
			DUMP		2.0 ± 0.3	2.6

Machine model						PC27MR-2	
Cate-gory	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Work equipment	Work equipment speed	Blade speed	★For measuring posture, see Fig. K at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position.	RAISE	sec	1.0 ± 0.3	1.6
				LOWER		1.0 ± 0.3	1.6
		Boom swing speed	★For measuring posture, see Fig. L at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	Swing boom to LEFT		7.0 ± 1.5	10
				Swing boom to RIGHT		7.0 ± 1.5	10
	Time lag	Boom time lag	★For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.			Max. 2	Max. 3.9
		Arm time lag	★For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Bucket time lag	★For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Blade time lag	★For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.			Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Relieve circuit to be measured.		cc/min	Max. 2	10
		Leakage from center swivel joint				—	—
—	Performance of hydraulic pump		See section of PERFORMANCE OF HYDRAULIC PUMP.				

Machine model					PC30MR-2	
Cate-gory	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	Speed when 1 pump is relieved	• Hydraulic oil temperature: 45 – 55°C • Engine oil pressure: Within operating range • Engine coolant temperature: Within operating range • Relief of 1 pump: Relieve bucket circuit. • Relief of 2 pumps: Relieve bucket and swing circuits.		rpm	Min. 2,250	Min. 2,250
	Speed when 2 pumps are relieved				Min. 2,040	Min. 2,040
Stroke of control valve spool	Boom control valve	★For details, see Fig. A at the end of this section.		mm	ℓ = 30 a = 6 b = 6	ℓ = 30 a = 6 b = 6
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	• Stop engine. • Measure at center of lever grip. • Measure at pedal tip. • Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	80 ± 10	80 ± 10
	Arm control lever		N → IN, OUT		80 ± 10	80 ± 10
	Bucket control lever		N → CURL, DUMP		80 ± 10	80 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		80 ± 10	80 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 20	160 ± 20
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 5	Max. 5

Machine model					PC30MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Operating effort of control levers and pedals	Boom control lever	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Install push-pull scale to center of lever grip or pedal tip to measure. • Read max. value to stroke end.		N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Arm control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Bucket control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Swing control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Boom swing control pedal				78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}
	Blade control lever				29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}
	Travel control lever				19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}
	Fuel control lever		Idle → Full throttle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
			Full throttle → Idle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
Oil pressure	Unload pressure	• Hydraulic oil temperature: 45 – 55°C • Set all levers in neutral. • Run engine at full throttle. • Measure pump outlet pressure.		MPa {kg/cm²} Target value (Range)	$3.9^{+0.98}_{0}$ {39.6^{+10}_{0}}	$3.9^{+0.98}_{0}$ {39.6^{+10}_{0}}
	Boom relief pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle and measure relief pressure (Relieve only circuit to be measured). • Measure pump outlet pressure.			$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}	$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}
	Arm relief pressure				$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}	$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}
	Bucket relief pressure				$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}	$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}
	Swing relief pressure				19.6 ± 0.98 {200 ± 10}	19.6 ± 0.98 {200 ± 10}
	Boom swing relief pressure				$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}	$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}
	Blade relief pressure		Raise		$21.6^{+0.98}_{-0.49}$ {220^{+10}_{-5}}	$21.6^{+0.98}_{-0.49}$ {220^{+10}_{-5}}
			Lower		$21.6^{+0.98}_{-0.49}$ {220^{+10}_{-5}}	$21.6^{+0.98}_{-0.49}$ {220^{+10}_{-5}}
	Travel relief pressure				$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}	$26.0^{+0.98}_{-0.49}$ {265^{+10}_{-5}}
	Control circuit oil pressure (Oil pressure lowered by self pressure)	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Measure circuit oil pressure when all control levers are in neutral. • Measure pump outlet pressure.			$2.94^{+0.49}_{-0.1}$ {30^{+5}_{-1}}	$2.94^{+0.49}_{-0.1}$ {30^{+5}_{-1}}

Machine model					PC30MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Pump outlet pressure - LS pressure	When all levers are in neutral	MPa {kg/cm²} Target value (Range)	$3.9^{+0.98}_{0}$ {39.6^{+10}_{0}}	$3.9^{+0.98}_{0}$ {39.6^{+10}_{0}}
			While bucket is curled with no load (full throttle)		1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}
Swing	Overrun of swing	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Stop after swinging 1 turn and measure shifting distance of swing circle. • Value in ( ) is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to pass 90-degree and 180-degree points after starting swinging.	90 deg.	sec	2.3 ± 0.3	2.9
			180 deg.		—	—
	Time required for swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to swing 5 turns after swinging 1 turn.			33 ± 3	38
	Hydraulic drift of swing	★For measuring posture, see Fig. C at end of this section. • Max. reach • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Fill bucket with rated load or dirt and sand. (Rated load: 1,422 N {145 kg}) • Stop machine on slope of 15 degrees and set its upper structure at 45 degrees upward. • Make match marks on swing circle outer race and track frame. • Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Relieve swing circuit and measure leakage in 1 minute.		cc/min	—	—
Travel	Travel speed	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on flat ground, measure time required to travel 20 m. • ( ): Machine with steel shoe specification	Low speed	sec	27.7 ± 2 (26.9 ± 2)	27.7 ± 4 (26.9 ± 4)
			High speed		15.7 ± 2 (15.3 ± 2)	15.7 ± 4 (15.3 ± 4)
	Travel deviation	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on hard and flat ground, measure travel deviation X in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 300	330
			High speed		Max. 300	330

Machine model						PC30MR-2	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Hydraulic drift of travel		★For measuring posture, see Fig. F at end of this section. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Stop machine on slope of 30 degrees with sprocket on upper side. • Measure hydraulic drift of travel in 5 minutes.		mm	0	0
Travel	Leakage from travel motor		• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Lock shoe to relieve travel circuit.		ℓ/min	—	—
Work equipment	Hydraulic drift	Whole work equipment (Hydraulic drift of bucket tooth tip)	★For measuring posture, see Fig. G at end of this section. • Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position. • Stop machine on level and flat ground. • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set lever in neutral. • Stop engine • Hydraulic oil temperature: 45 – 55°C • Start measurement just after setting. • Measure hydraulic drift every 5 minutes for 15 minutes.		mm	Max. 300	450
		Boom cylinder (Retraction of cylinder)				Max. 20	30
		Arm cylinder (Extension of cylinder)				Max. 20	30
		Bucket cylinder (Retraction of cylinder)				Max. 20	30
		Boom swing cylinder (Retraction and extension of cylinder)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set machine in above position on slope of 15 degrees with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.			Max. 20	30
		Blade (Hydraulic drift of blade tip)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Measure hydraulic drift of blade tip from maximum raising height for 15 minutes.			Max. 30	45
	Work equipment speed	Boom speed	★For measuring posture, see Fig. H at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground.	RAISE	sec	2.6 ± 0.3	3.2
				LOWER		2.6 ± 0.3	3.2
		Arm speed	★For measuring posture, see Fig. I at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	IN		2.8 ± 0.3	3.4
				OUT		2.5 ± 0.3	3.1
		Bucket speed	★For measuring posture, see Fig. J at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	CURL		2.6 ± 0.3	3.2
				DUMP		1.9 ± 0.3	2.5

Machine model						PC30MR-2	
Cate-gory	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Work equipment	Work equipment speed	Blade speed	★For measuring posture, see Fig. K at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position.	RAISE	sec	1.0 ± 0.3	1.6
				LOWER		1.0 ± 0.3	1.6
		Boom swing speed	★For measuring posture, see Fig. L at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	Swing boom to LEFT		7.5 ± 1.5	10
				Swing boom to RIGHT		7.5 ± 1.5	10
	Time lag	Boom time lag	★For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.			Max. 2	Max. 3.9
		Arm time lag	★For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Bucket time lag	★For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Blade time lag	★For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.			Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Relieve circuit to be measured.		cc/min	Max. 2	10
		Leakage from center swivel joint				—	—
—	Performance of hydraulic pump		See section of PERFORMANCE OF HYDRAULIC PUMP.				

Machine model					PC35MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	Speed when 1 pump is relieved	• Hydraulic oil temperature: 45 – 55°C • Engine oil pressure: Within operating range • Engine coolant temperature: Within operating range • Relief of 1 pump: Relieve bucket circuit. • Relief of 2 pumps: Relieve bucket and swing circuits.		rpm	Min. 2,160	Min. 2,160
	Speed when 2 pumps are relieved				Min. 1,955	Min. 1,955
Stroke of control valve spool	Boom control valve	★For details, see Fig. A at the end of this section.		mm	ℓ = 30 a = 6 b = 6	ℓ = 30 a = 6 b = 6
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	• Stop engine. • Measure at center of lever grip. • Measure at pedal tip. • Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	80 ± 10	80 ± 10
	Arm control lever		N → IN, OUT		80 ± 10	80 ± 10
	Bucket control lever		N → CURL, DUMP		80 ± 10	80 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		80 ± 10	80 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 10	160 ± 10
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 5	Max. 5

Machine model				PC35MR-2	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Operating effort of control levers and pedals	Boom control lever	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Install push-pull scale to center of lever grip or pedal tip to measure. • Read max. value to stroke end.	N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Arm control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Bucket control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Swing control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Boom swing control pedal			78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3}
	Blade control lever			29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}
	Travel control lever			19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}
	Fuel control lever	Idle → Full throttle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
		Full throttle → Idle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
Oil pressure	Unload pressure	• Hydraulic oil temperature: 45 – 55°C • Set all levers in neutral. • Run engine at full throttle. • Measure pump outlet pressure.	MPa {kg/cm²} Target value (Range)	$3.2^{+0.98}_{0}$ $\{33^{+10}_{0}\}$	$3.2^{+0.98}_{0}$ $\{33^{+10}_{0}\}$
	Boom relief pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle and measure relief pressure (Relieve only circuit to be measured). • Measure pump outlet pressure.		$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$	$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$
	Arm relief pressure			$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$	$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$
	Bucket relief pressure			$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$	$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$
	Swing relief pressure			19.6 ± 0.98 {200 ± 10}	19.6 ± 0.98 {200 ± 10}
	Boom swing relief pressure			$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$	$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$
	Blade relief pressure	Raise		$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$	$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$
		Lower		$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$	$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$
	Travel relief pressure			$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$	$26.0^{+0.98}_{-0.49}$ $\{265^{+10}_{-5}\}$
	Control pump circuit oil pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Measure circuit oil pressure when all control levers are in neutral.		$3.73^{+0.39}_{-0.1}$ $\{38^{+4}_{-1}\}$	$3.73^{+0.39}_{-0.1}$ $\{38^{+4}_{-1}\}$

Machine model					PC35MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Pump outlet pressure - LS pressure	When all levers are in neutral	MPa {kg/cm²}	$3.2^{+0.98}_{0}$ {33^{+10}_{0}}	$3.2^{+0.98}_{0}$ {33^{+10}_{0}}
			While bucket is curled with no load (full throttle)	Target value (Range)	1.41 ± 0.1 {14.4 ± 1}	1.41 ± 0.1 {14.4 ± 1}
Swing	Overrun of swing	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Stop after swinging 1 turn and measure shifting distance of swing circle. • Value in ( ) is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to pass 90-degree and 180-degree points after starting swinging.	90 deg.	sec	2.2 ± 0.3	2.8
			180 deg.	sec	—	—
	Time required for swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to swing 5 turns after swinging 1 turn.		sec	33 ± 4	41
	Hydraulic drift of swing	★For measuring posture, see Fig. C at end of this section. • Max. reach • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Fill bucket with rated load or dirt and sand. (Rated load: 1,765 N {180 kg}) • Stop machine on slope of 15 degrees and set its upper structure at 45 degrees upward. • Make match marks on swing circle outer race and track frame. • Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Relieve swing circuit and measure leakage in 1 minute.		cc/min	—	—
Travel	Travel speed	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on flat ground, measure time required to travel 20 m. • ( ): Machine with steel shoe specification	Low speed	sec	25.7 ± 2 (25.0 ± 2)	25.7 ± 4 (25.0 ± 4)
			High speed	sec	15.7 ± 2 (15.3 ± 2)	15.7 ± 4 (15.3 ± 4)
	Travel deviation	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on hard and flat ground, measure travel deviation X in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 300	330
			High speed	mm	Max. 300	330

Machine model						PC35MR-2	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Hydraulic drift of travel		★For measuring posture, see Fig. F at end of this section. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Stop machine on slope of 30 degrees with sprocket on upper side. • Measure hydraulic drift of travel in 5 minutes.		mm	0	0
Travel	Leakage from travel motor		• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Lock shoe to relieve travel circuit.		ℓ/min	—	—
Work equipment	Hydraulic drift	Whole work equipment (Hydraulic drift of bucket tooth tip)	★For measuring posture, see Fig. G at end of this section. • Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position. • Stop machine on level and flat ground. • Bucket: Rated load (Rated load: 1,765 N {180 kg}) • Set lever in neutral. • Stop engine • Hydraulic oil temperature: 45 – 55°C • Start measurement just after setting. • Measure hydraulic drift every 5 minutes for 15 minutes.		mm	Max. 300	450
		Boom cylinder (Retraction of cylinder)				Max. 10	15
		Arm cylinder (Extension of cylinder)				Max. 29	44
		Bucket cylinder (Retraction of cylinder)				Max. 16	24
		Boom swing cylinder (Retraction and extension of cylinder)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load (Rated load: 1,765 N {180 kg}) • Set machine in above position on slope of 15 degrees with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.			Max. 20	30
		Blade (Hydraulic drift of blade tip)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Measure hydraulic drift of blade tip from maximum raising height for 15 minutes.			Max. 30	45
	Work equipment speed	Boom speed	★For measuring posture, see Fig. H at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground.	RAISE	sec	2.9 ± 0.3	3.5
				LOWER		2.9 ± 0.3	3.5
		Arm speed	★For measuring posture, see Fig. I at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	IN		2.8 ± 0.3	3.4
				OUT		2.5 ± 0.3	3.1
		Bucket speed	★For measuring posture, see Fig. J at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	CURL		2.7 ± 0.3	3.3
				DUMP		2.0 ± 0.3	2.6

Machine model						PC35MR-2	
Cate-gory	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Work equipment	Work equipment speed	Blade speed	★For measuring posture, see Fig. K at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position.	RAISE	sec	1.2 ± 0.3	1.6
				LOWER		1.2 ± 0.3	1.6
		Boom swing speed	★For measuring posture, see Fig. L at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	Swing boom to LEFT		7.3 ± 1.5	10
				Swing boom to RIGHT		7.1 ± 1.5	10
	Time lag	Boom time lag	★For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.			Max. 2	Max. 3.9
		Arm time lag	★For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Bucket time lag	★For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.			Max. 1	Max. 2
		Blade time lag	★For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.			Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Relieve circuit to be measured.		cc/min	Max. 2	10
		Leakage from center swivel joint				—	—
—	Performance of hydraulic pump		See section of PERFORMANCE OF HYDRAULIC PUMP.				

Category	Item	Measurement conditions		Unit	Standard value for new machine (PC40, 50MR-2)	Service limit value (PC40, 50MR-2)
Engine speed	Speed when 1 pump is relieved	• Hydraulic oil temperature: 45 – 55°C • Engine oil pressure: Within operating range • Engine coolant temperature: Within operating range • Relief of 1 pump: Relieve bucket circuit. • Relief of 2 pumps: Relieve bucket and swing circuits.		rpm	Min. 2,170	Min. 2,170
	Speed when 2 pumps are relieved				Min. 2,100	Min. 2,100
Stroke of control valve spool	Boom control valve	★For details, see Fig. A at the end of this section.		mm	ℓ = 30 a = 6 b = 6	ℓ = 30 a = 6 b = 6
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	• Stop engine. • Measure at center of lever grip. • Measure at pedal tip. • Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	85 ± 10	85 ± 10
	Arm control lever		N → IN, OUT		85 ± 10	85 ± 10
	Bucket control lever		N → CURL, DUMP		85 ± 10	85 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		85 ± 10	85 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 20	160 ± 20
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 10	Max. 10

Machine model					PC40, 50MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Operating effort of control levers and pedals	Boom control lever	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Install push-pull scale to center of lever grip or pedal tip to measure. • Read max. value to stroke end.		N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Arm control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Bucket control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Swing control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}
	Boom swing control pedal				78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}
	Blade control lever				29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}
	Travel control lever				22.5 ± 4.9 {2.3 ± 0.5}	22.5 ± 9.8 {2.3 ± 1}
	Fuel control lever		Idle → Full throttle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
			Full throttle → Idle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
Oil pressure	Unload pressure	• Hydraulic oil temperature: 45 – 55°C • Set all levers in neutral. • Run engine at full throttle. • Measure pump outlet pressure.		MPa {kg/cm²} Target value (Range)	3.2 ± 0.49 {33 ± 5}	3.2 ± 0.49 {33 ± 5}
	Boom relief pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle and measure relief pressure (Relieve only circuit to be measured). • Measure pump outlet pressure.			26.5 ± 0.98 {270 ± 10}	26.5 ± 0.98 {270 ± 10}
	Arm relief pressure				26.5 ± 0.98 {270 ± 10}	26.5 ± 0.98 {270 ± 10}
	Bucket relief pressure				26.5 ± 0.98 {270 ± 10}	26.5 ± 0.98 {270 ± 10}
	Swing relief pressure				19.6 ± 0.98 {200 ± 10}	19.6 ± 0.98 {200 ± 10}
	Boom swing relief pressure				26.5 ± 0.98 {270 ± 10}	26.5 ± 0.98 {270 ± 10}
	Blade relief pressure		Raise		$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$	$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$
			Lower		$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$	$21.6^{+0.98}_{-0.49}$ $\{220^{+10}_{-5}\}$
	Travel relief pressure				$26.5^{+0.98}_{-0.49}$ $\{270^{+10}_{-5}\}$	$26.5^{+0.98}_{-0.49}$ $\{270^{+10}_{-5}\}$
	Control circuit oil pressure (Oil pressure lowered by self pressure)	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Measure circuit oil pressure when all control levers are in neutral. • Measure pump outlet pressure.			$3.73^{+0.39}_{-0.1}$ $\{38^{+4}_{-1}\}$	$3.73^{+0.39}_{-0.1}$ $\{38^{+4}_{-1}\}$
	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Run engine at full throttle. • Pump outlet pressure - LS pressure	When all levers are in neutral		3.2 ± 0.49 {33 ± 5}	3.2 ± 0.49 {33 ± 5}
			While bucket is curled with no load (full throttle)		1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}

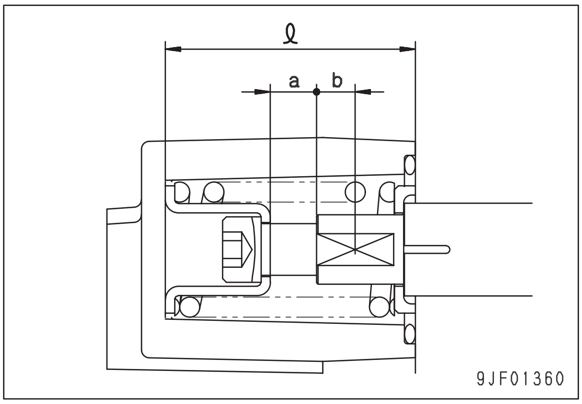
Machine model					PC40, 50MR-2	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Swing	Overrun of swing	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Stop after swinging 1 turn and measure shifting distance of swing circle. • Value in ( ) is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to pass 90-degree and 180-degree points after starting swinging.	90 deg.	sec	2.3 ± 0.3	2.9
			180 deg.		—	—
	Time required for swinging	★For measuring posture, see Fig. B at end of this section. • No load, max. reach • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to swing 5 turns after swinging 1 turn.			33 ± 3	38
	Hydraulic drift of swing	★For measuring posture, see Fig. C at end of this section. • Max. reach • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Fill bucket with rated load or dirt and sand. • Rated load PC40MR-2: 2,245 N {230 kg} PC50MR-2: 2,450 N {250 kg} • Stop machine on slope of 15 degrees and set its upper structure at 45 degrees upward. • Make match marks on swing circle outer race and track frame. • Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Relieve swing circuit and measure leakage in 1 minute.		cc/min	—	—
Travel	Travel speed	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on flat ground, measure time required to travel 20 m. • ( ): Machine with steel shoe specification	Low speed	sec	25.7 ± 2 (27.7 ± 2)	25.7 ± 4 (26.9 ± 4)
			High speed		15.7 ± 2 (16.7 ± 2)	15.7 ± 4 (16.7 ± 4)
	Travel deviation	★For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on hard and flat ground, measure travel deviation X in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 300	330
			High speed		Max. 300	330

Machine model						PC40, 50MR-2			
Cate-gory		Item	Measurement conditions		Unit	Standard value for new machine		Service limit value	
						PC40MR	PC50MR	PC40MR	PC50MR
Travel		Hydraulic drift of travel	★For measuring posture, see Fig. F at end of this section. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Stop machine on slope of 30 degrees with sprocket on upper side. • Measure hydraulic drift of travel in 5 minutes.		mm	0		0	
Travel		Leakage from travel motor	• Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Lock shoe to relieve travel circuit.		ℓ/min	—		—	
Work equipment	Hydraulic drift	Whole work equipment (Hydraulic drift of bucket tooth tip)	★For measuring posture, see Fig. G at end of this section. • Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position. • Stop machine on level and flat ground. • Bucket: Rated load PC40MR-2: 2,254 N {230 kg} PC50MR-2: 2,450 N {250 kg} • Set lever in neutral. • Stop engine • Hydraulic oil temperature: 45 – 55°C • Start measurement just after setting. • Measure hydraulic drift every 5 minutes for 15 minutes.		mm	Max. 300		450	
		Boom cylinder (Retraction of cylinder)				Max. 6 (PC40MR-2) Max. 7 (PC50MR-2)		9 (PC40MR-2) 11 (PC50MR-2)	
		Arm cylinder (Extension of cylinder)				Max. 30		45	
		Bucket cylinder (Retraction of cylinder)				Max. 16		24	
		Boom swing cylinder (Retraction and extension of cylinder)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load PC40MR-2: 2,254 N {230 kg} PC50MR-2: 2,450 N {250 kg} • Set machine in above position on slope of 15 degrees with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.			Max. 20		30	
		Blade (Hydraulic drift of blade tip)	• Stop engine • Hydraulic oil temperature: 45 – 55°C • Measure hydraulic drift of blade tip from maximum raising height for 15 minutes.			Max. 30		45	
	Work equipment speed	Boom speed	★For measuring posture, see Fig. H at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground.	RAISE	sec	3.0 ± 0.3		3.6	
				LOWER		3.0 ± 0.3		3.6	
		Arm speed	★For measuring posture, see Fig. I at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	IN		3.1 ± 0.3	3.4 ± 0.3	3.7	4.0
				OUT		2.7 ± 0.3	2.8 ± 0.3	3.3	3.4
		Bucket speed	★For measuring posture, see Fig. J at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	CURL		3.0 ± 0.3		3.6	
				DUMP		2.2 ± 0.3		2.8	

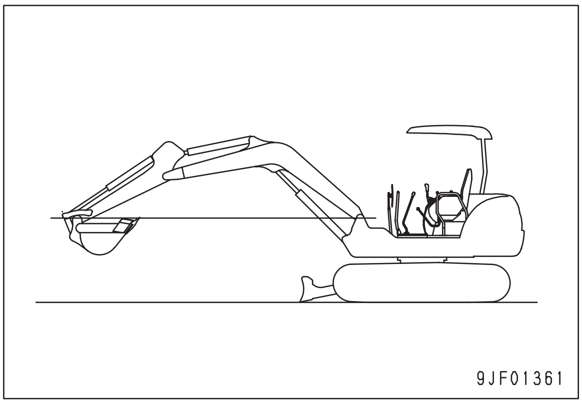
<table>
<tr><th colspan="5">Machine model</th><th colspan="2">PC40, 50MR-2</th></tr>
<tr><th>Cate-gory</th><th colspan="2">Item</th><th colspan="2">Measurement conditions</th><th>Unit</th><th>Standard value for new machine</th><th>Service limit value</th></tr>
<tr><td rowspan="10">Work equipment</td><td rowspan="4">Work equipment speed</td><td rowspan="2">Blade speed</td><td rowspan="2">★For measuring posture, see Fig. K at end of this section.
• Run engine at full throttle.
• Hydraulic oil temperature: 45 – 55°C
• Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position.</td><td>RAISE</td><td rowspan="8">sec</td><td>1.3 ± 0.3</td><td>1.9</td></tr>
<tr><td>LOWER</td><td>1.3 ± 0.3</td><td>1.9</td></tr>
<tr><td rowspan="2">Boom swing speed</td><td rowspan="2">★For measuring posture, see Fig. L at end of this section.
• Run engine at full throttle.
• Hydraulic oil temperature: 45 – 55°C
• Measure time required to move cylinder between extension and retraction stroke ends.</td><td>Swing boom to LEFT</td><td>7.0 ± 1.5</td><td>10</td></tr>
<tr><td>Swing boom to RIGHT</td><td>7.0 ± 1.5</td><td>10</td></tr>
<tr><td rowspan="4">Time lag</td><td>Boom time lag</td><td colspan="2">★For measuring posture, see Fig. M at end of this section.
• Run engine slow.
• Hydraulic oil temperature: 45 – 55°C
• Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.</td><td>Max. 2</td><td>Max. 3.9</td></tr>
<tr><td>Arm time lag</td><td colspan="2">★For measuring posture, see Fig. N at end of this section.
• Run engine slow.
• Hydraulic oil temperature: 45 – 55°C
• Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.</td><td>0</td><td>Max. 1</td></tr>
<tr><td>Bucket time lag</td><td colspan="2">★For measuring posture, see Fig. O at end of this section.
• Run engine slow.
• Hydraulic oil temperature: 45 – 55°C
• Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.</td><td>0</td><td>Max. 1</td></tr>
<tr><td>Blade time lag</td><td colspan="2">★For measuring posture, see Fig. P at end of this section.
• Run engine slow.
• Hydraulic oil temperature: 45 – 55°C
• Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.</td><td>Max. 1</td><td>Max. 2</td></tr>
<tr><td rowspan="2">Internal leakage</td><td>Leakage from each cylinder</td><td colspan="2" rowspan="2">• Hydraulic oil temperature: 45 – 55°C
• Run engine at full throttle.
• Relieve circuit to be measured.</td><td rowspan="2">cc/min</td><td>Max. 2</td><td>10</td></tr>
<tr><td>Leakage from center swivel joint</td><td>—</td><td>—</td></tr>
<tr><td>—</td><td colspan="2">Performance of hydraulic pump</td><td colspan="5">See section of PERFORMANCE OF HYDRAULIC PUMP.</td></tr>
</table>

Posture of machine for measuring performance and measurement procedure

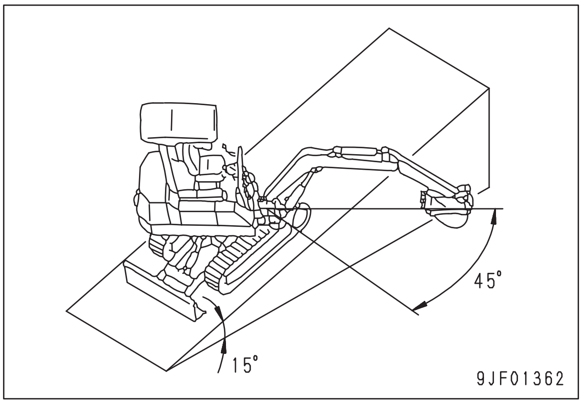
★ Fig. A



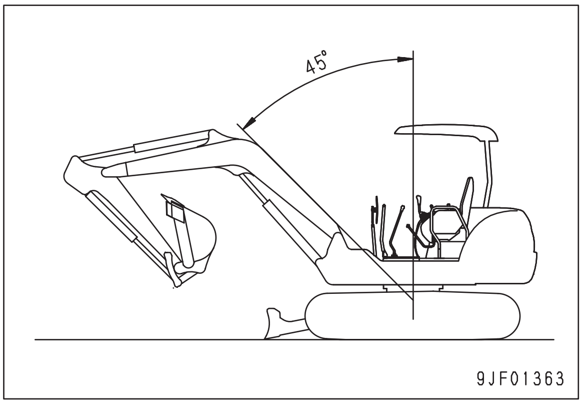
★ Fig. B



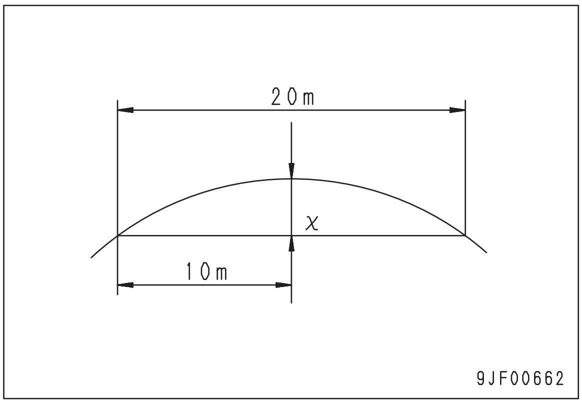
★ Fig. C



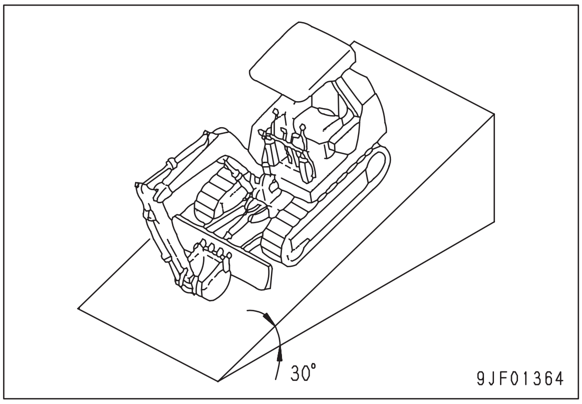
★ Fig. D



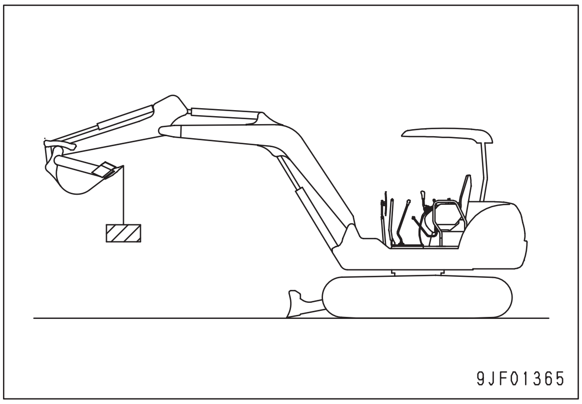
★ Fig. E



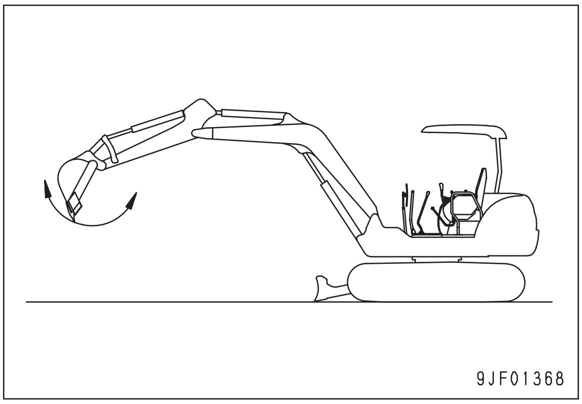
★ Fig. F



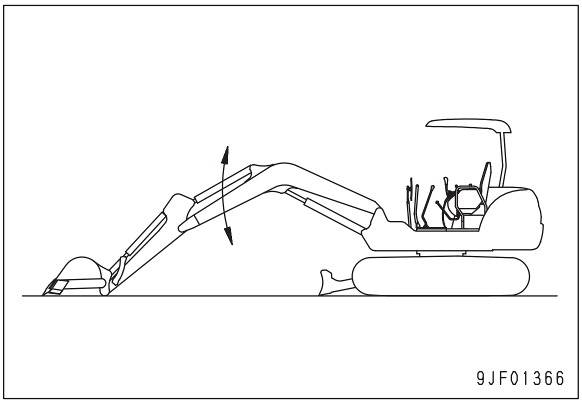
★ Fig. G



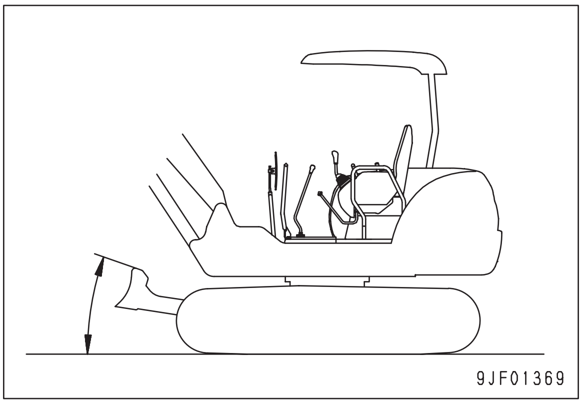
★ Fig. J



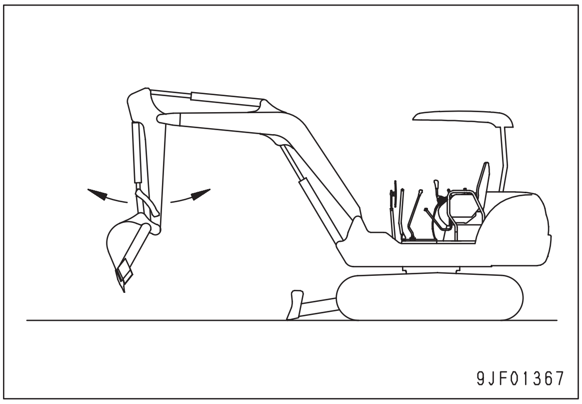
★ Fig. H



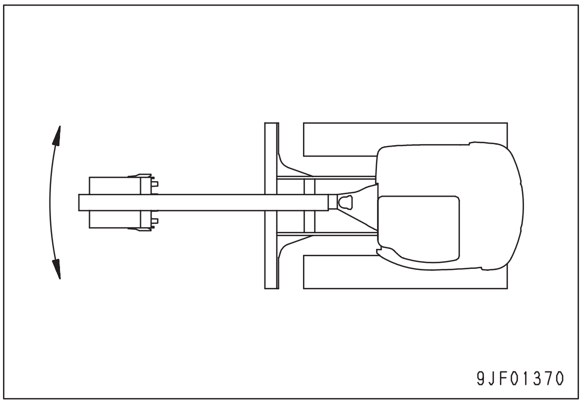
★ Fig. K



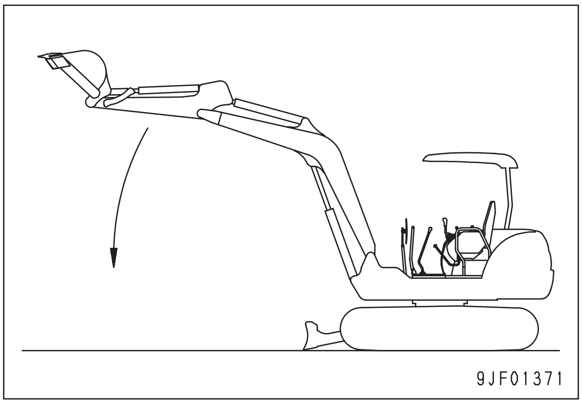
★ Fig. I



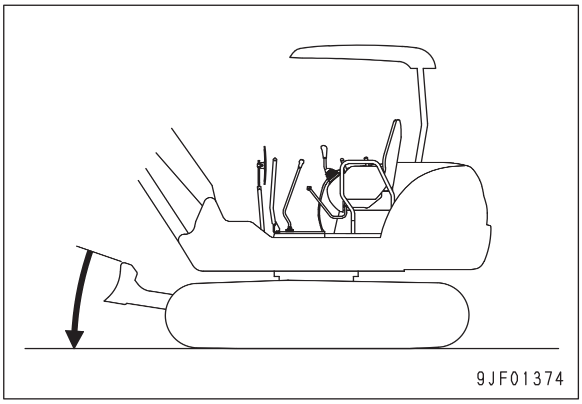
★ Fig. L



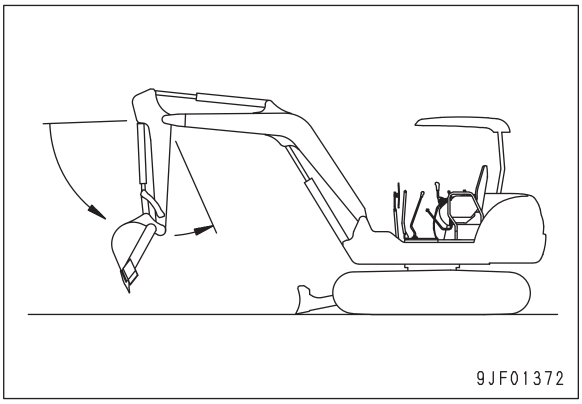
★ Fig. M



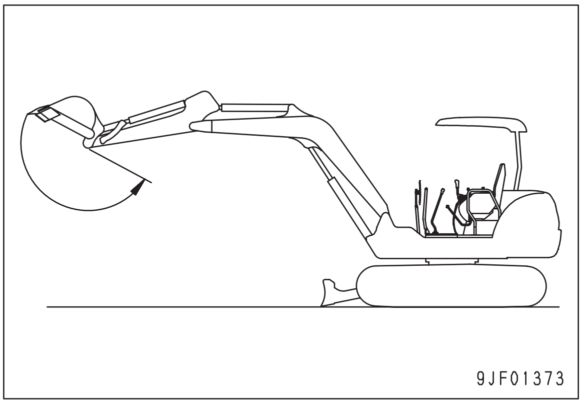
★ Fig. P



★ Fig. N



★ Fig. O

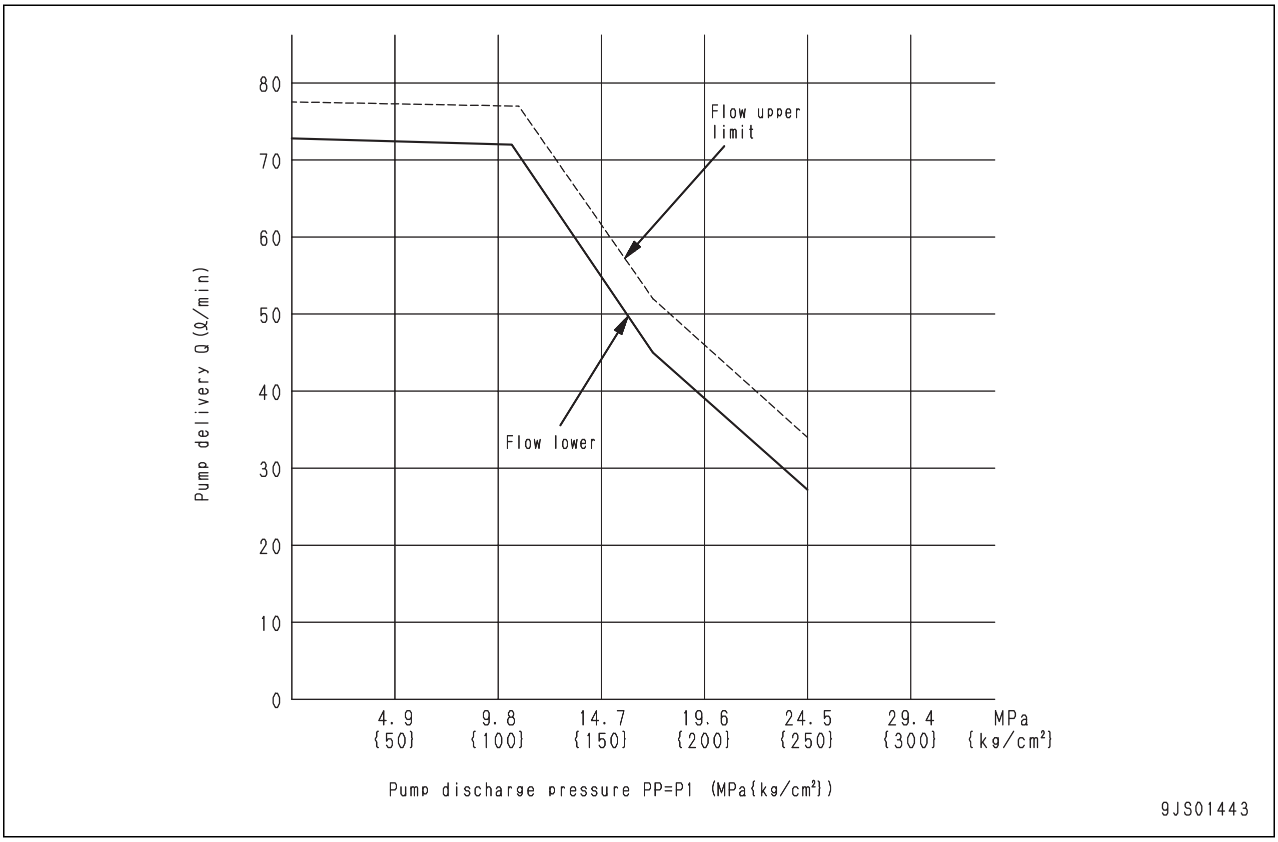


PERFORMANCE OF HYDRAULIC PUMP

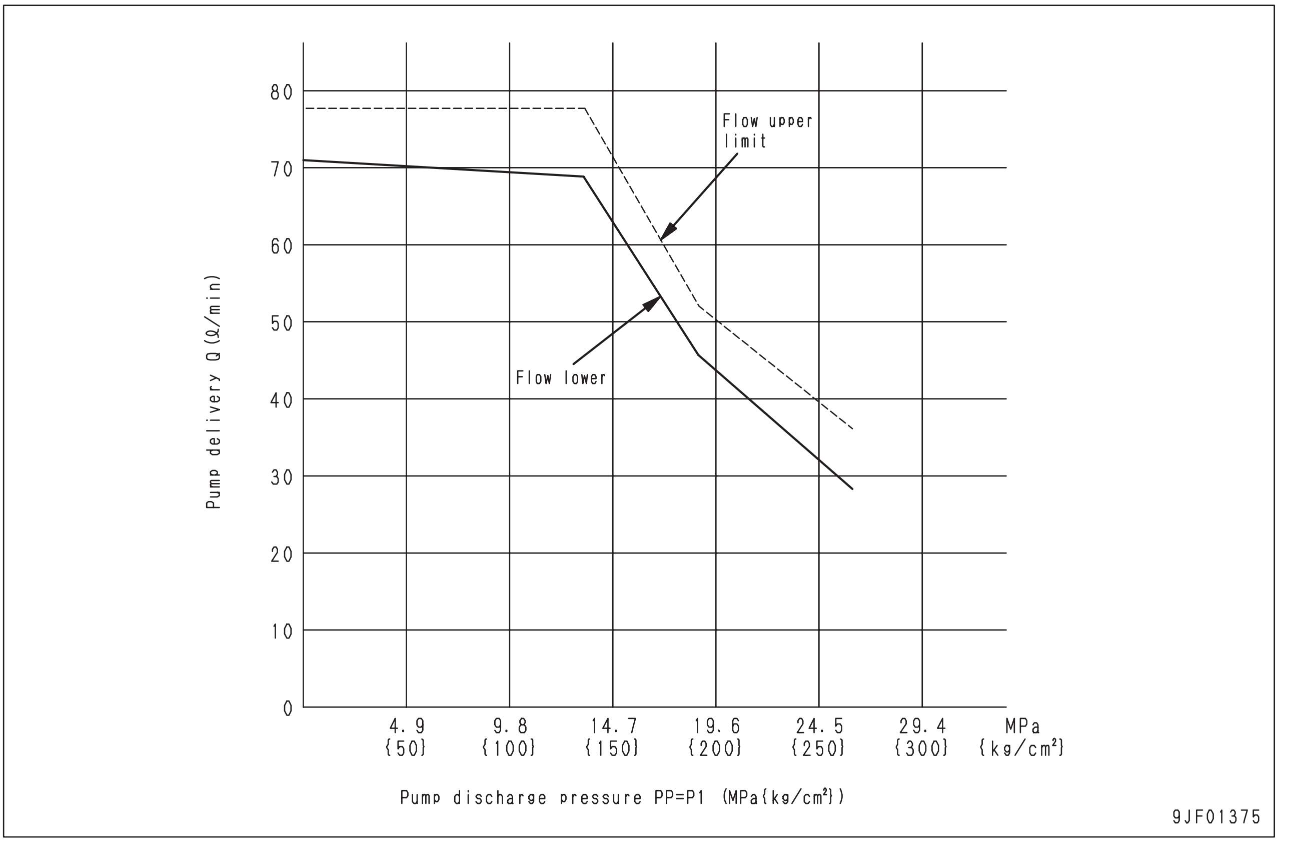
Item	Measurement conditions	Machine model	Unit	Standard value for new machine	Service limit value
Discharge of gear pump	• Hydraulic oil temperature: 45 – 55°C • Run engine at rated speed. • Measure at set pressure of relief valve.	PC27MR-2	ℓ/min	20.3	16.6
		PC30MR-2		20.4	16.8
		PC35MR-2		19.6	16.1
		PC40MR-2 PC50MR-2		32.5	26.5

Item	Measurement conditions	Machine model	Checkpoint	Discharge pressure of test pump (MPa{kg/cm²})	Discharge pressure of the other pump (MPa{kg/cm²})	Average discharge pressure (MPa{kg/cm²})	Standard discharge Q(ℓ/min)	Criterion Q(ℓ/min)
Discharge of piston pump	• Hydraulic oil temperature: 45 – 55°C • Engine speed: 2,500 rpm • Apply no load to gear pump. ★Avoid measuring near broken part of graph since error become large at that part.	PC27MR-2	Any point	P1	—	P	★See Fig. Q.	★See Fig. Q.
		PC30MR-2					★See Fig. R.	★See Fig. R.
		PC35MR-2			P2	(P1+P2)/2	★See Fig. S.	★See Fig. S.
		PC40MR-2 PC50MR-2					★See Fig. T.	★See Fig. T.

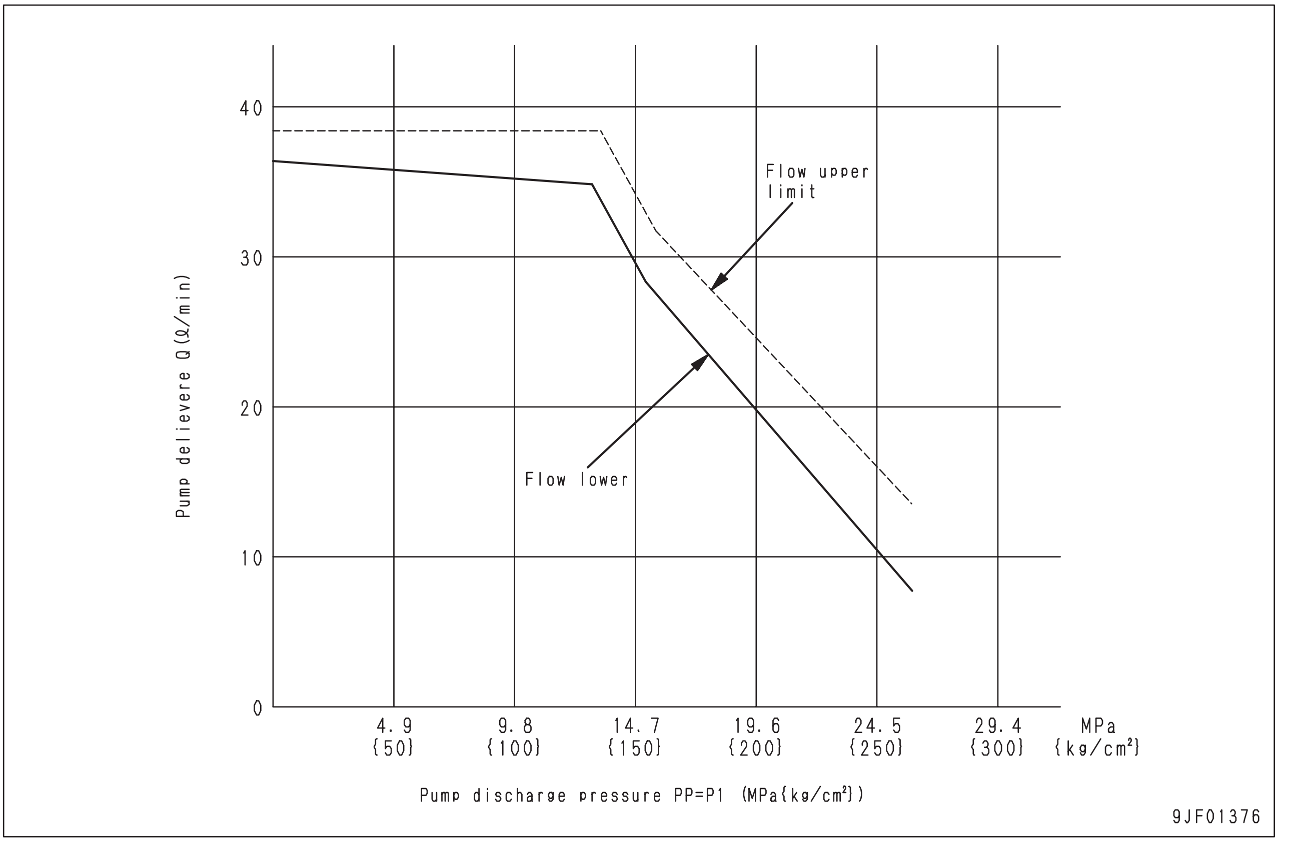
★ Fig. Q



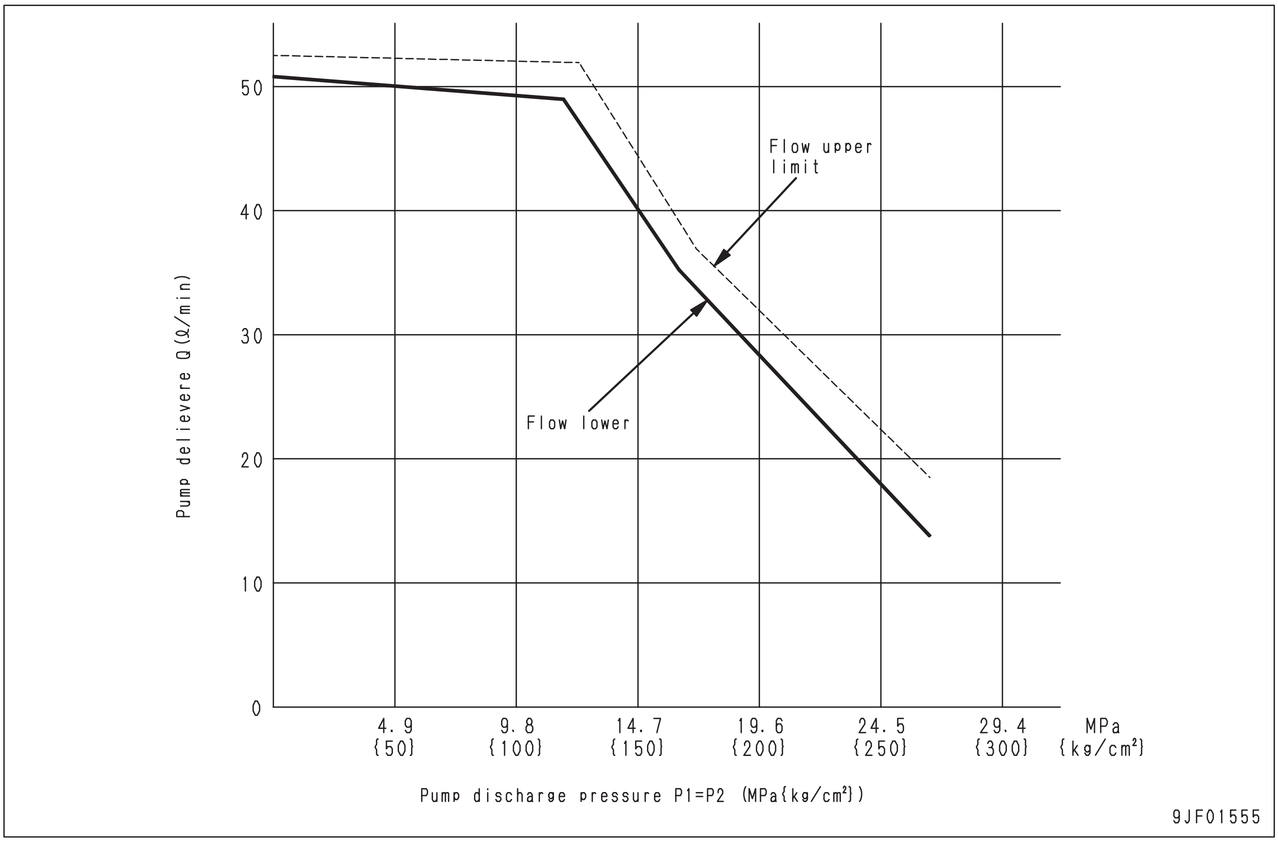
★ Fig. R


Flow upper limit
Flow lower
Pump delivery Q (ℓ/min)
0
10
20
30
40
50
60
70
80
4.9 {50}
9.8 {100}
14.7 {150}
19.6 {200}
24.5 {250}
29.4 {300}
MPa {kg/cm²}
Pump discharge pressure PP=P1 (MPa{kg/cm²})
9JF01375

★ Fig. S


Flow upper limit
Flow lower
Pump delievere Q (ℓ/min)
0
10
20
30
40
4.9 {50}
9.8 {100}
14.7 {150}
19.6 {200}
24.5 {250}
29.4 {300}
MPa {kg/cm²}
Pump discharge pressure PP=P1 (MPa{kg/cm²})
9JF01376

★ Fig. T


Pump delievere Q (ℓ/min)
50
40
30
20
10
0
Flow upper limit
Flow lower
4.9 {50}
9.8 {100}
14.7 {150}
19.6 {200}
24.5 {250}
29.4 {300}
MPa {kg/cm²}
Pump discharge pressure P1=P2 (MPa{kg/cm²})
9JF01555

TESTING AND ADJUSTING

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LIST OF TESTING, ADJUSTING, AND TROUBLESHOOTING TOOLS

Testing/Adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Measuring engine speed	A		799-205-1100	Tachometer kit	1	Degital display: 6.0 – 99,999.9 rpm
Measuring coolant temperature, oil temperature, and exhaust temperature	B		799-101-1502	Digital thermometer	1	- 99.9 – 1,299°C
Measuring exhaust gas color	C	1	799-201-9001	Handy smoke checker	1	Bosch index 0 – 9 (With standard color)
		2	Commercially available	Smoke meter	1	
Adjusting valve clearance	D		Commercially available	Feeler gauge	1	—
Measuring compression pressure	E	1	795-502-1590	Compression gauge	1	0 – 6.9 MPa {0 – 70 kg/cm²} KIT No.: 795-502-1205
		2	795-111-1110	Adapter	1	—
		3	795-101-1571	Joint	1	—
Measuring engine oil pressure	F	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-401-2320	Oil pressure gauge	1	Pressure gauge: 0.98 MPa {10kg/cm²}
Measuring and adjusting oil pressures in work equipment, travel, boom swing, swing, and blade circuits	G	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-101-5220	Nipple	1	10 x 1.25 mm
			07002-11023	O-ring	1	—
Measuring LS differential pressure	H	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-101-5220	Nipple	2	10 x 1.25 mm
			07002-11023	O-ring	2	—
		3	799-401-2701	Differential pressure gauge	1	—
		4	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: PT1/8)
			02896-11008	O-ring	1	
		5	799-401-3200	Adapter	1	Face seal type (#03) Both male and female: 11/16-16UNF (Female: PT1/8)
			02896-11009	O-ring	1	
Measuring control circuit oil pressure (oil pressure reduced by self pressure)	J	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: PT1/8)
			02896-11008	O-ring	1	

Testing/Adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Testing and adjusting control pump circuit oil pressure	K	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-101-5220	Nipple	1	10 x 1.25 mm
			07002-11023	O-ring	1	—
Measuring solenoid valve output pressure	L	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: PT1/8)
			02896-11008	O-ring	1	
Measuring PPC valve output pressure and swing holding brake release pressure	M	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm²}
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 58.8 MPa {600kg/cm²}
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: PT1/8)
			02896-11008	O-ring	1	
Measuring leakage from work equipment cylinder	N		Commercially available	Measuring cylinder	1	—
Measuring swing circle bearing clearance	P		Commercially available	Dial gauge	1	—
Measuring operating effort and pressing force	–		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
			79A-264-0091		1	0 – 490 N {0 – 50 kg}
Measuring stroke and hydraulic drift	–		Commercially available	Scale	1	—
Measuring work equipment speed	–		Commercially available	Stopwatch	1	—
Measuring voltage an resistance	–		Commercially available	Multimeter	1	—

★ For the model names and part Nos. of the T-boxes and T-adapters used for troubleshooting for the monitor panel, controllers, sensors, actuators, and wiring harnesses, see TROUBLESHOOTING, List of T-boxes and T-adapters.

MEASURING ENGINE SPEED

★ Measuring instruments for engine speed

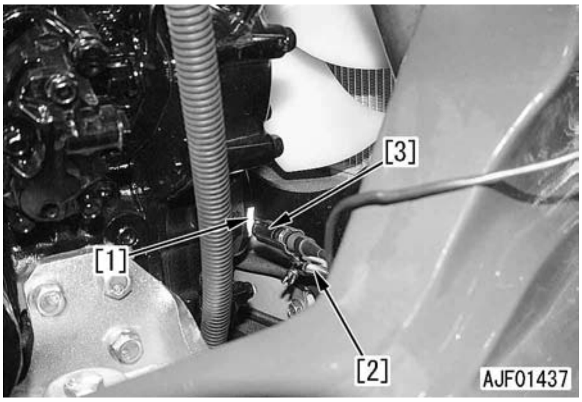
Symbol	Part No.	Part name
A	799-205-1100	Tachometer kit

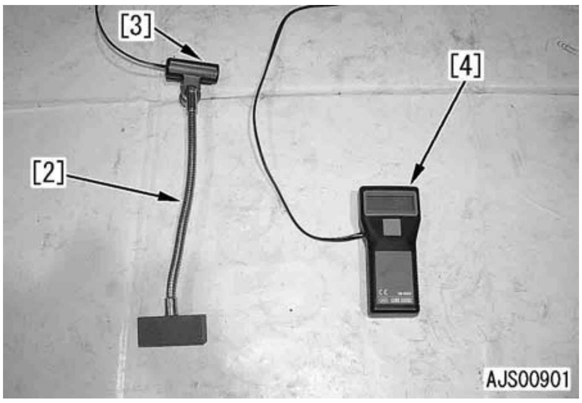
★ Measure the engine speed under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature : 45 – 55°C

⚠ When installing and removing the measuring instruments, take care not to touch a hot part of the engine.

1. Open the engine side cover and stick reflection tape [1] tachometer kit A to the crank pulley.

2. Set probe [3] with stand [2], matching it to reflection tape [1], and connect it to tachometer [4].





3. Run the engine and measure the engine speed under the following condition.

1) Measuring low idle and high idle speeds:
Set the fuel control lever to the low idle and high idle positions and measure the engine speed.
2) Measuring pump relief engine speed:
Lock the work equipment or travel system to relieve the main pump, run the engine at full throttle, and measure the engine speed.

MEASUREMENT OF EXHAUST GAS COLOR

★ Exhaust gas color measurement tool

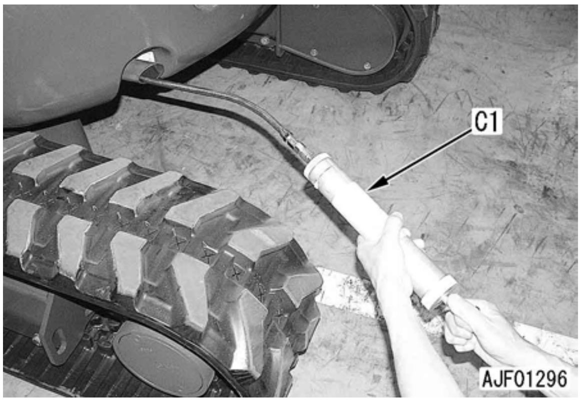
Symbol		Part No.	Part name
C	1	799-201-9001	Handy Smoke Checker
	2	Commercially available	Smoke Meter

⚠ Be careful not to touch the highly heated parts, while fitting and detaching a measurement tool.

★ If no compressed air or power is not available in the field, use Handy Smoke Checker **C1**. For recording official data, use Smoke Meter **C2**.

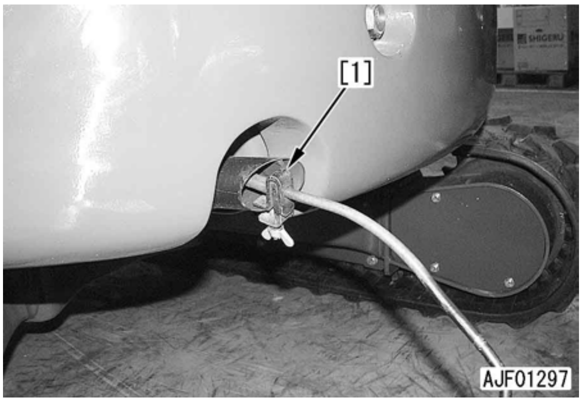
1. Measurement with Handy Smoke Checker C1

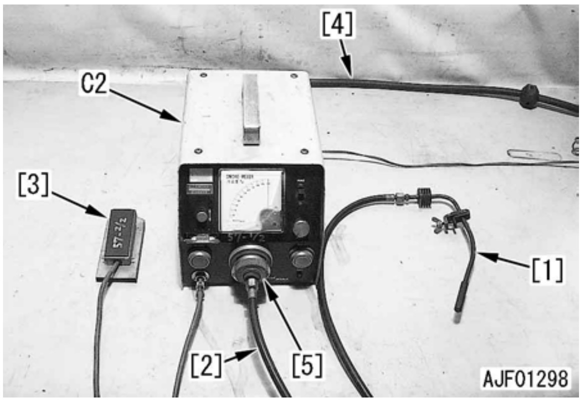
1) Fit a filtering paper to Handy Smoke Checker **C1**.
2) Insert the exhaust gas intake pipe into the exhaust pipe.
3) Accelerate the engine sharply and operate the handle of smoke checker **C1** simultaneously to let the exhaust gas stay on the filtering paper.
4) Take out the filtering paper and compare it with the attached scale for judgement.



2. Measurement with Smoke Meter C2

1) Insert probe [1] of the Smoke Meter **C2** into the exhaust gas pipe outlet, and fasten it to the outlet with a clip.
2) Connect the probe hose [2], accelerator switch [3] outlet and air hose [4] to the Smoke Meter **C2**.
   ★ Keep the pressure of the supplied compressed air below 1.47 MPa {15 kg/cm^2}.
3) Connect the power cable to AC socket.
   ★ Confirm that the Smoke Meter power switch is in the OFF position, before connecting the power cable to an outlet.
4) Fit a filtering paper by loosening the suction pump cap nut [5].
   ★ Fit the filtering paper securely so that air may not leak.
5) Move the Smoke Meter **C2** power switch to the ON position.
6) Accelerate the engine sharply and depress accelerator pedal [3] of smoke meter **C2** simultaneously to let the exhaust gas stay on the filtering paper.
7) Put the polluted filtering paper on non-polluted filtering paper (more than 10 sheets) in the filtering paper holder, and read the indicated value.





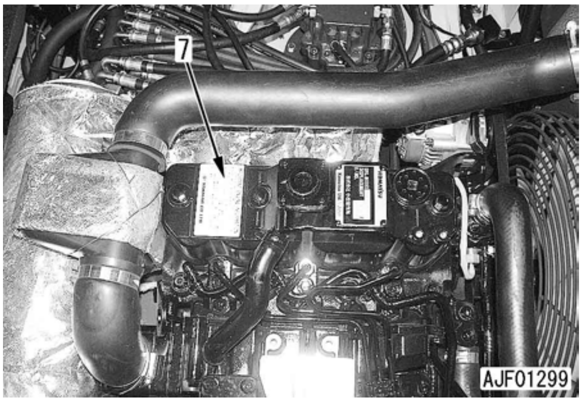
ADJUSTING VALVE CLEARANCE

★ Adjusting tools for valve clearance

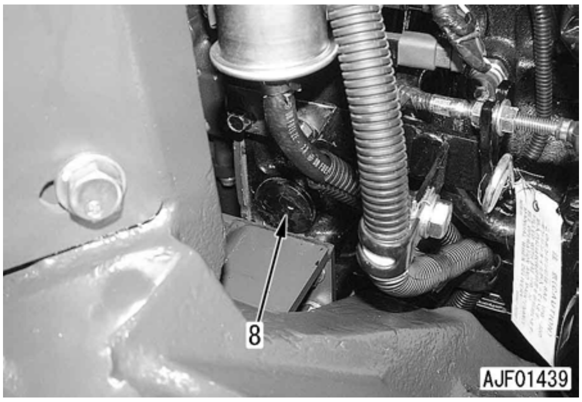
Symbol	Part No.	Part name
D	Commercially available	Feeler gauge

1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

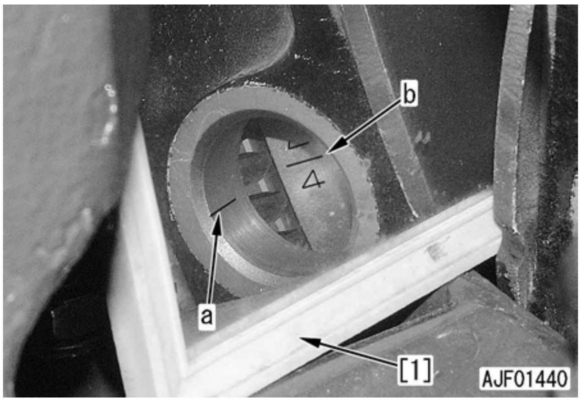
2. Remove cylinder head cover (7).



3. Remove the inspection window cap (8) of the flywheel housing.

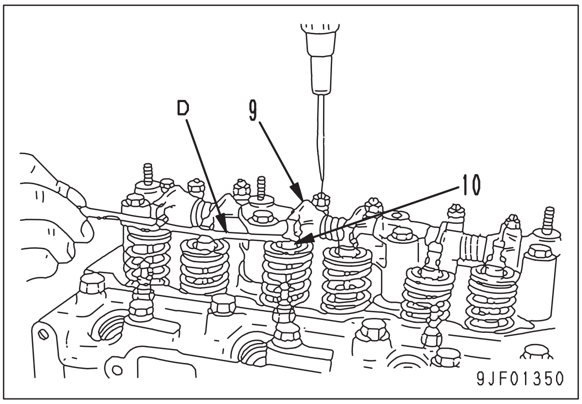


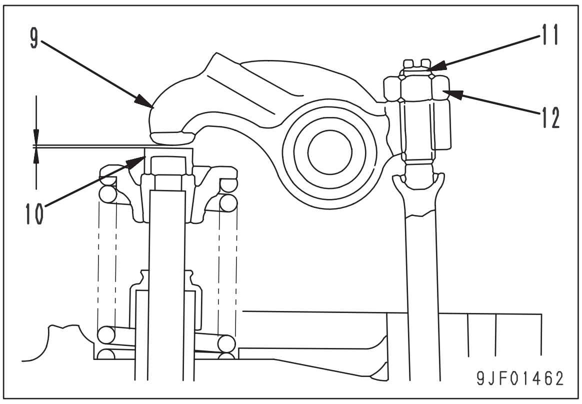
4. Watching the movement of the valve of the No. 1 cylinder (on the flywheel side), rotate the crankshaft forward to match stamp line **a** of the flywheel housing to stamp line **b** of flywheel No. 1.
   ★ See stamp lines **a** and **b** by using a mirror [1].
   ★ Since a mirror is used, the number is seen inverted.
   Example of PC40, 50MR-2



   ★ The cylinder on the flywheel side is the No. 1 cylinder.
   ★ When the cylinder piston is at the compression top dead center, the rocker arms of both intake valve and exhaust valve can be moved by the valve clearance. If the rocker arms do not move, rotate the crankshaft 1 more turn.

5. Insert feeler gauge **D** between rocker arm (9) and valve cap (10) and tighten adjustment screw (11) to a degree that the gauge moves lightly, then tighten locknut (12).
   Locknut:
   25.48 ± 2.94 Nm {2.6 ± 0.3 kgm}
   ★ Rotate the crankshaft by 180 degrees and adjust the valve clearance of each cylinder in the firing order.
   • Firing order: 1 – 3 – 2 (For PC27, 30, 35MR-2)
     : 1 – 3 – 4 – 2 (For PC40, 50MR-2)
   ★ There is a stamp line on the flywheel for the top dead center of each cylinder.





6. After finishing adjustment, tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

MEASURING COMPRESSION PRESSURE

★ Measuring instruments for compression pressure

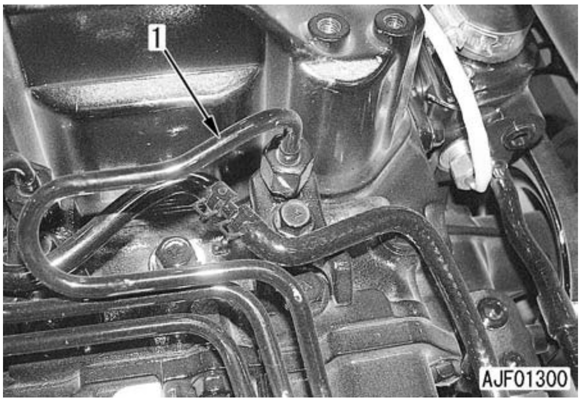
Symbol		Part No.	Part name
E	1	795-502-1590	Compression gauge
	2	795-111-1110	Adapter
	3	795-101-1571	Joint

⚠ When measuring the compression pressure, take care not to burn yourself on the exhaust manifold, muffler, etc. or get caught in the fan, fan belt, or another rotating part.

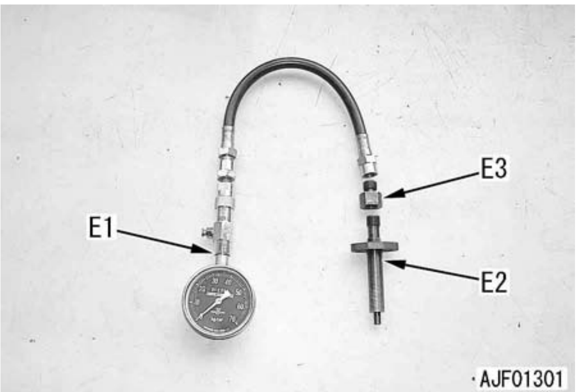
1. Adjust the valve clearance.
   For details, see ADJUSTING VALVE CLEARANCE.

2. Warm up the engine until the engine oil temperature rises to 40 – 60°C.

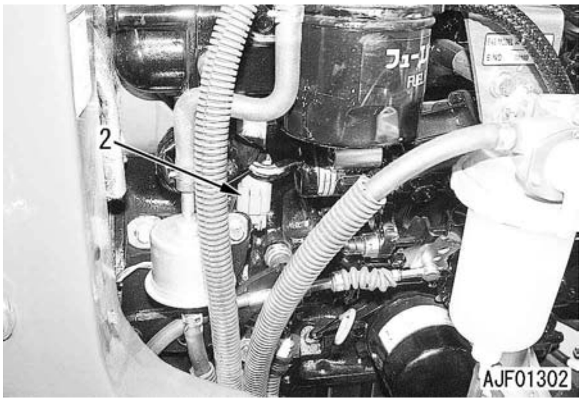
3. Remove nozzle holder assembly (1) of the cylinder to be measured.



4. Install adapter **E2** and joint **E3** to the nozzle holder mounting part and connect compression gauge **E1**.
   Adapter mounting nut:
   4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}



5. Disconnect connector **E3** (2) of the engine stop motor.



6. Crank the engine with the starting motor and measure the compression pressure.
   ★ Read the compression gauge when its pointer is stabilized.
   ★ After measuring the compression pressure, install the nozzle holder assembly.
   Nozzle holder assembly mounting nut:
   4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}

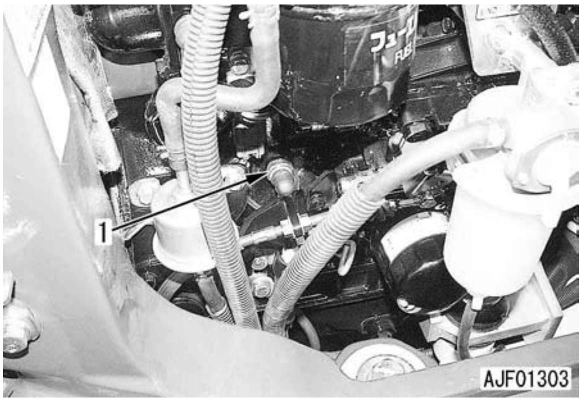
MEASURING ENGINE OIL PRESSURE

★ Measuring instruments for engine oil pressure

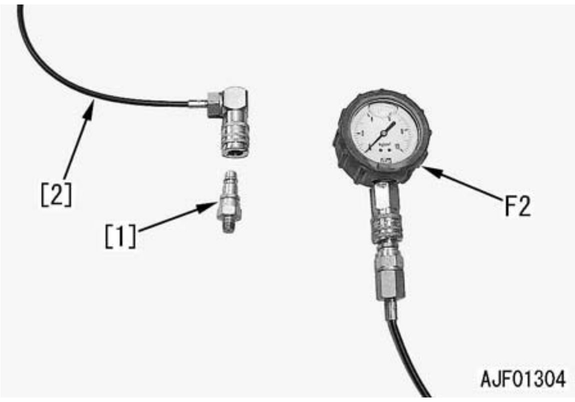
Symbol		Part No.	Part name
F	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-401-2320	Oil pressure gauge

★ Measure the engine oil pressure under the following condition.
- Coolant temperature: Within operating range

1. Open the engine side cover and remove engine oil pressure switch (1).



2. Install nipple [1] of oil pressure gauge kit **F1** and connect oil pressure gauge **F2** (9.8 MPa {10 kg/cm^2}) by hose [2].

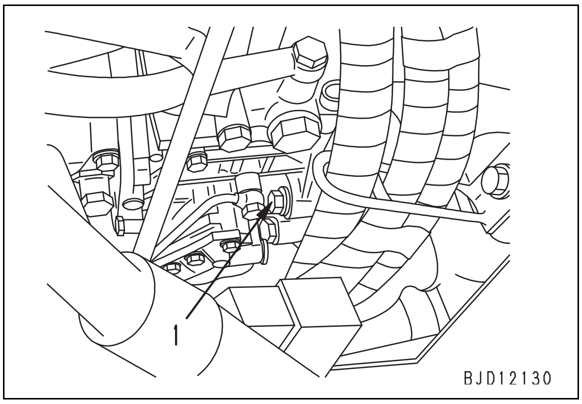


3. Start the engine and measure the oil pressure at low idle and high idle.

TESTING AND ADJUSTING FUEL INJECTION TIMING

TESTING

Open the engine side cover and check mounting nut (1) of the fuel injection pump for looseness.

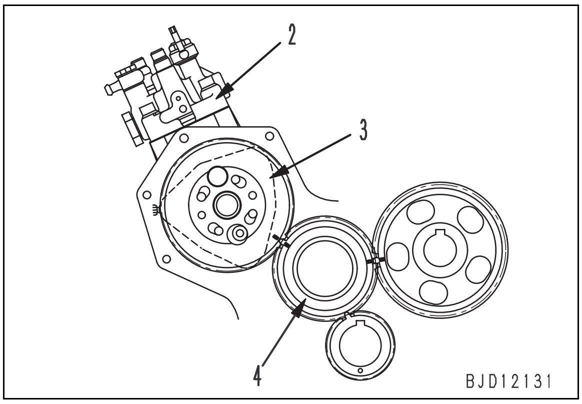


★ The fuel injection timing does not change as long as the mounting nut is not loosened. Accordingly, when removing and installing or replacing the fuel injection pump beforehand refer to the following adjusting procedure.

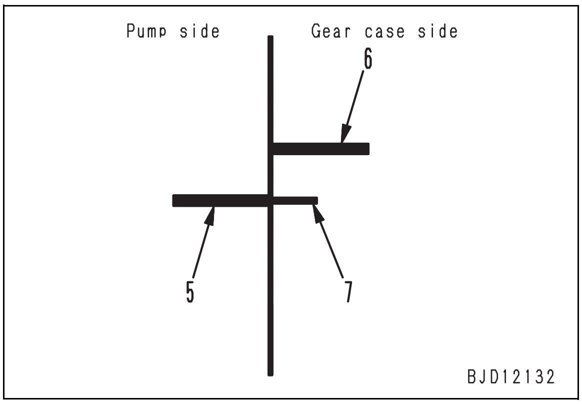
ADJUSTING

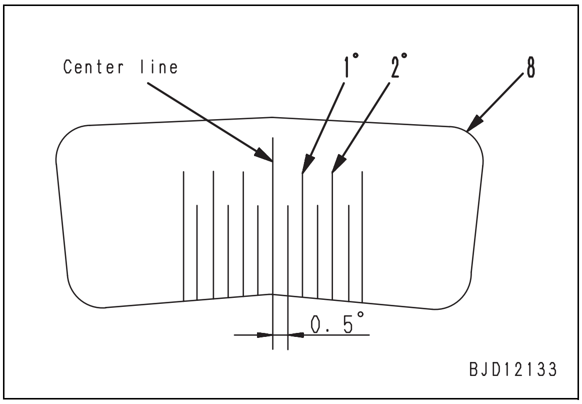
★ The injection timing of the fuel injection pump used engine cannot be adjusted like the former models. Accordingly, adjust the injection angle instead of measuring the injection timong.

1. Before removing fuel injection pump (2), remove the cover in front of the timing gear case and make match marks on the meshing parts of pump drive gear (3) and idle gear (4).



2. Accurately record the relative positions of stamped line (5) of the fuel injection pump body and stamped line (6) of the gear case with mark-off lines (7), etc.
3. Stick injection angle adjustment seal (8) to the gear case, matching its center line to stamped line (5) of the fuel injection pump body.
   - Seal (8) number: YM158090-51990





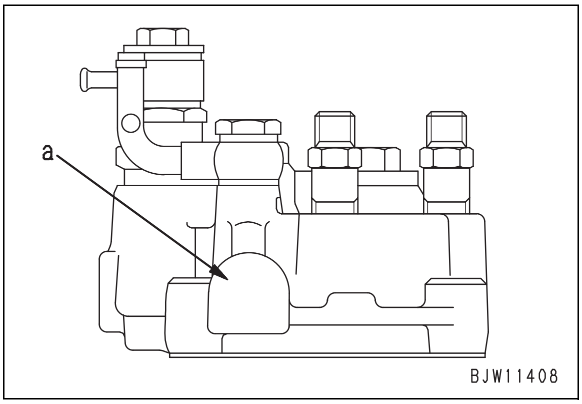
4. Referring to DISASSEMBLY AND ASSENBLY, Removal, installation of fuel injection pump assembly, remove the fuel injection pump and read "injection angle θi" recorded on it.

★ Injection angle θi is stamped at position "**a**" on the left side (cylinder block side) of the fuel injection pump.
★ The stamped value is 10 times the value of injection angle θi.

(Example)

Injection angle θi (Cam angle)	Stamp
7.7	77
8.5	85

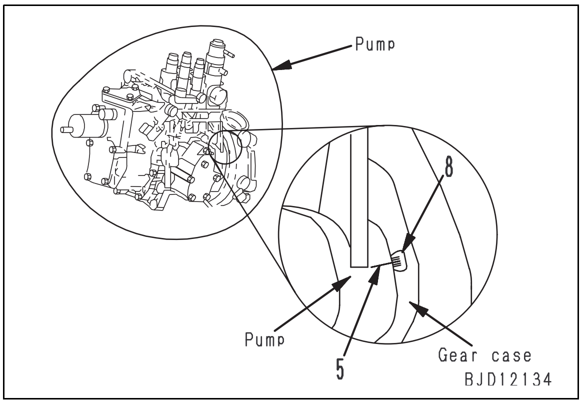
★ If the injection angle is difficult to read, notify YAMMAR of the injection pump No. and ask the injection angle.
★ For details of injection angle θi, see REMARKS in the following section.

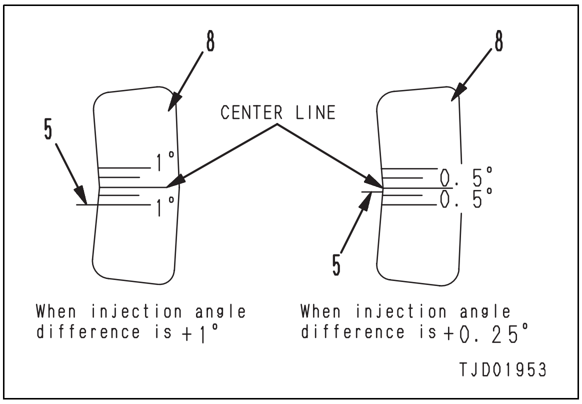


5. Read the "injection angle θi" recorded on the fuel injection pump to be installed and calucu-lated the difference between it and the "injection angle θi" of the removed fuel injection pump.
   ★ When the same fuel injection pump is installed again, the angle difference is 0.
   ★ Injection angle difference (Cam angle) = (Injection angle θi of fuel injection pump to be installed) – (Injection angle θi of removed fuel injection pump)

6. Install the fuel injection pump temporarily and tighten the nut at the shaft end.
   See Removal, installation of fuel injection pump.

7. Read the injection angle difference calculated in step 5 above by the scale of the injection angle adjustment seal (8) (Minimum division: 0.5 ° of cam angle) and adjust the installed angle of the fuel injection pump.
   ★ In the injection angle difference is +1°, lean the fuel injection pump away from the cylin-der block by 1°. If the injection angle differ-ence is -1°, lean the fuel injection pump toward the cylinder block by 1°.

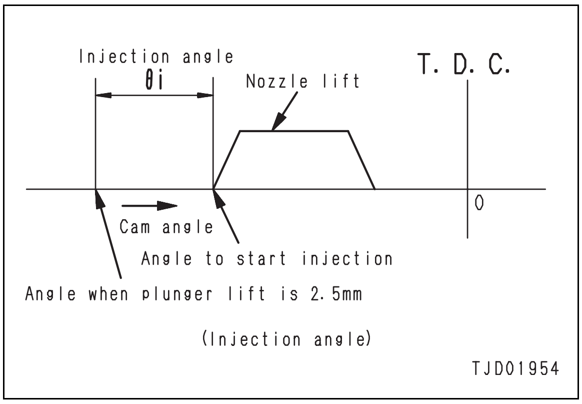




8. Tighten the fuel injection pump mounting nut.

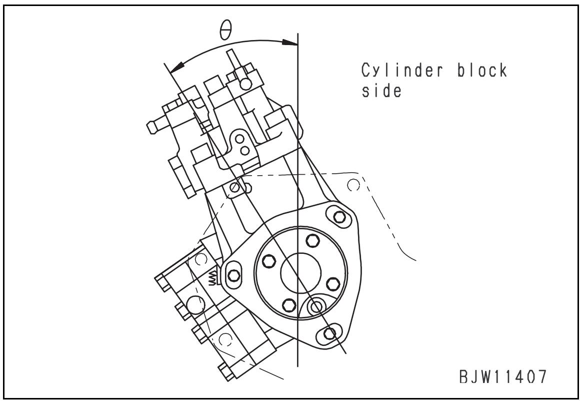
REMARK

Injection angle θi is the difference between the cam angle at which injection is started and the cam angle at which the plunger lift is 2.5 mm while the fuel injection pump unit is driven with a motor.
Actual injection angle θi is measured for each fuel injection pump and recorded on the pump body.



REFERENCE

Standard installed angle θ of fuel injection pump: 25°

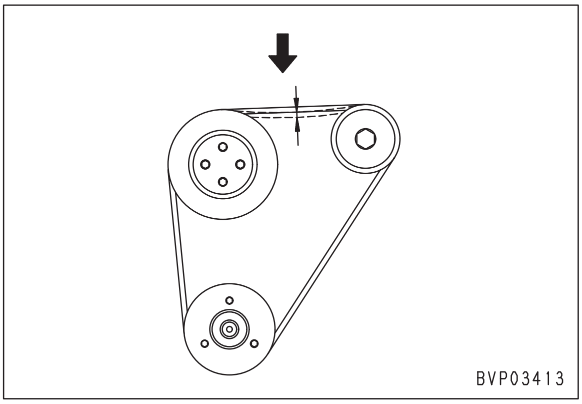


TESTING AND ADJUSTING ALTERNATOR BELT TENSION

TESTING

1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

2. Press the intermediate point between the alternator pulley and fan pulley with a force of about 98 N {10 kg}. If the belt deflection at this time is 5 – 6 mm, the belt tension is normal.



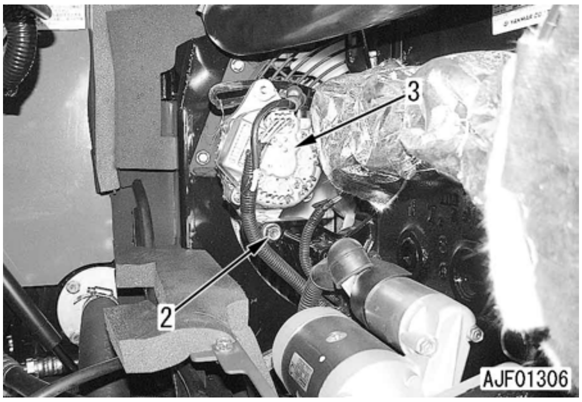
ADJUSTING

★ If the belt deflection is not normal, adjust it according to the following procedure.

1. Loosen belt tension adjustment bolt (1) and alternator mounting nut (2).

2. Using a bar, move alternator (3) toward the front of the machine and tighten belt tension adjustment bolt (1).

3. Tighten alternator mounting nut (2).



4. After finishing adjustment, tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

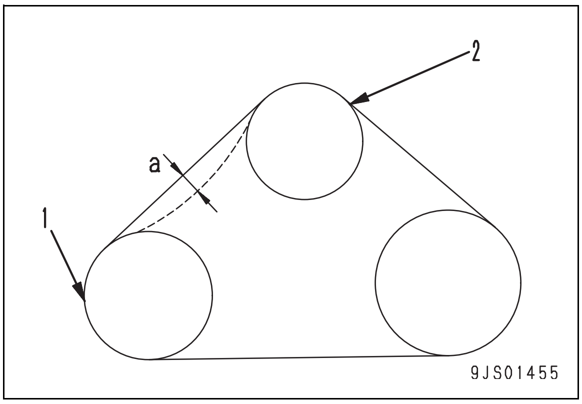
TESTING AND ADJUSTING AIR CONDITIONER COMPRESSOR BELT TENSION

TESTING

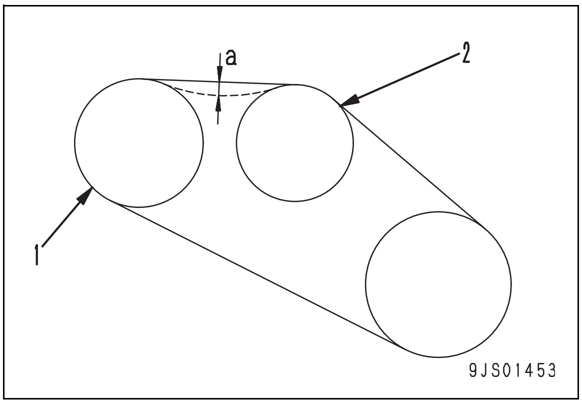
1. Open the engine side cover.

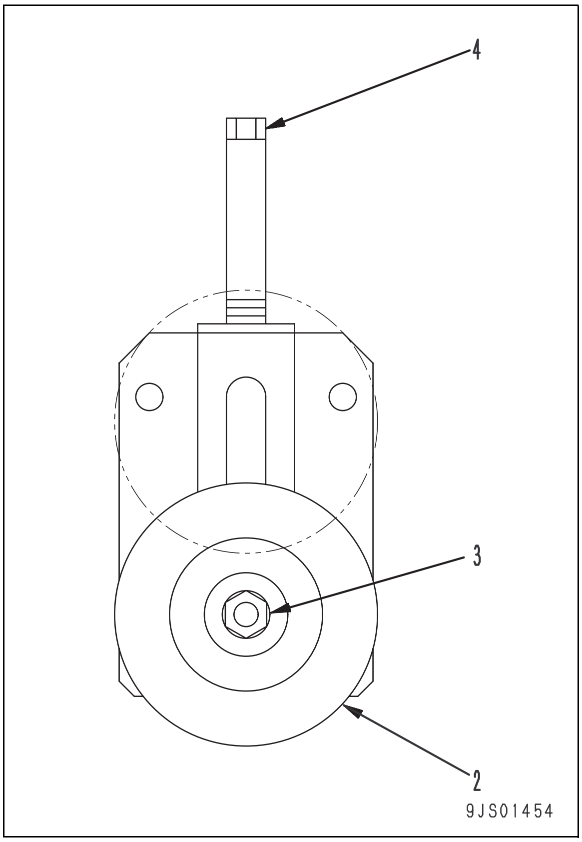
2. Press the intermediate point of the belt between compressor pulley (1) and idler pulley (2) with a finger and measure deflection (a) of the belt.
   - Force to press belt: Approx. 58.8 N {6 kg}
   - Deflection: 5 – 6 mm

   PC27, 30, 35MR-2



   PC40, 50MR-2





ADJUSTING

★ If the deflection of the belt is abnormal, adjust it according to the following procedure.

1. Loosen nut (3) of idler pulley (2).

2. Adjust the belt tension with adjustment nut (4).

3. Tighten nut (3).

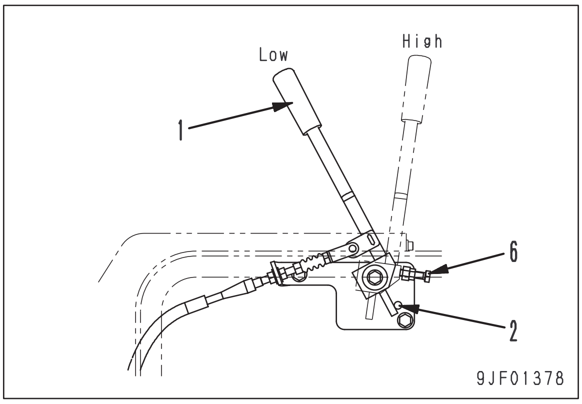
ADJUSTING FUEL CONTROL LEVER

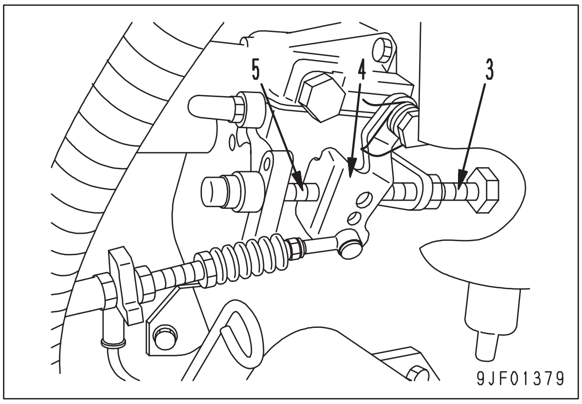
1. Adjusting low idle

1) Lean fuel control lever (1) forward until it touches stopper (2) on the low idle side.
2) Turn low idle adjustment screw (3) on the injection pump side so that low idle is set to the specified speed.

2. Adjusting high idle

1) Lean fuel control lever (1) backward until injection pump lever (4) touches stopper bolt (5) on the high idle side.
2) Under the above condition, bring stopper bolt (6) in contact with fuel control lever (1), then return it by 1/2 turn and secure it with the locknut.
   ★ The screw on the high idle side of the injection pump cannot be adjusted. Accordingly, if the high idle speed is still low when the screw on the high idle side touches the governor lever of the injection pump, test the injection nozzle, etc.





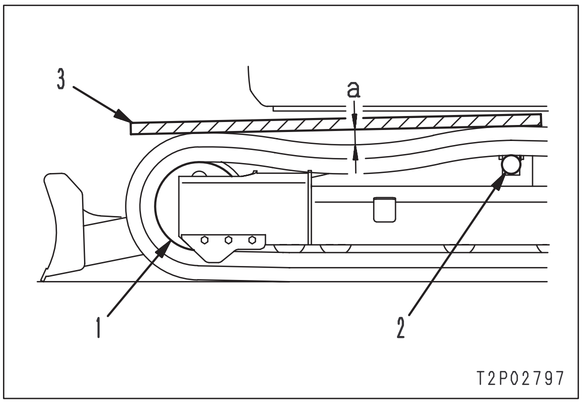
TESTING AND ADJUSTING TRACK SHOE TENSION

TESTING

1. Run the engine at low idle and move the machine by the length of track on ground, then stop slowly.

2. Place wood block (3) on the track shoe between idler (1) and carrier roller (2).

3. Measure maximum slack (a) between the top of the track shoe and wood block (3).
   - Standard slack (a):
     Rubber shoe: 1 – 3 mm
     Road liner, steel shoe: 10 – 30 mm



ADJUSTING

★ If the track shoe tension is abnormal, adjust it according to the following procedure.

1. When tension is too high

1) Loosen valve (1) and discharge grease.

   ⚠ Do not loosen the valve more than 1 turn. If it is loosened more, it may jump out because of the high-pressure grease in it.

   ★ If the grease does not flow out, move the machine slowly forward and in reverse.

2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
3) Test the track shoe tension again. If it is abnormal, adjust it again.

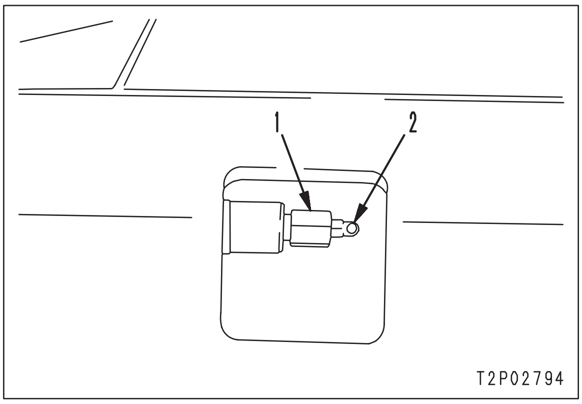
2. When tension is low

1) Supply grease through grease fitting (2).

   ★ If the shoe is not tensed properly, move the machine slowly forward and in reverse.

   Grease fitting: **Grease (G2-LI)**

2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
3) Test the track shoe tension again. If it is abnormal, adjust it again.



MEASUREMENT OF CLEARANCE IN SWING CIRCLE BEARINGS

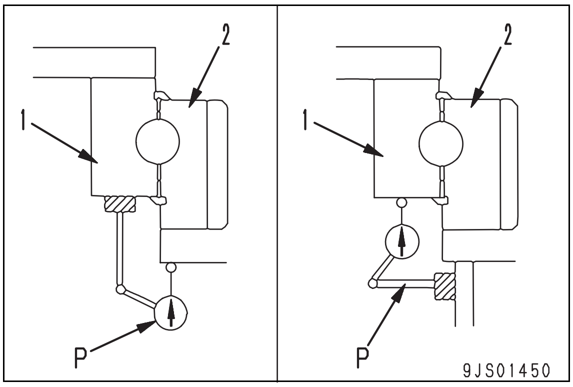
★ Swing circle bearing clearance measurement tools

Mark	Part No.	Part Name
P	Commercial Product	Dial Gauge

★ Follow the steps explained below, when measuring clearance in the swing circle bearing in the actual machine.

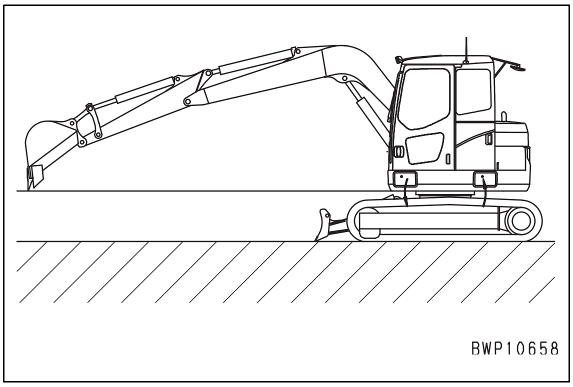
⚠ Be careful not to put a hand or foot under the track shoe, while taking measurement.

1. Fasten dial gauge **P** to swing circle outer race (1) or inner race (2), and contact the probe with the end surface of inner race (2) or outer race (1) on the opposite side.
   ★ Set dial gauge **P** at the machine front or rear.



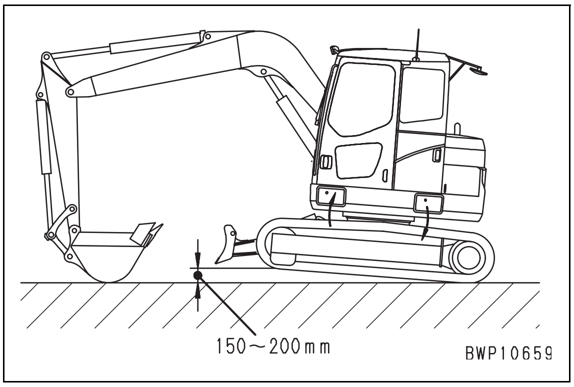
2. Keep the work equipment in the max. reach posture and keep the height of the bucket teeth tip level with the lower height of the revolving frame.

3. Set dial gauge **P** at zero point.



4. Hold the arm nearly perpendicular to the ground, and lower the boom until the track shoes will be lifted at the machine front.
   ★ The upper structure is raised at the front and lowered at the rear at that time.

5. Read off the value in dial gauge **P** in this condition.
   ★ The value indicated in dial gauge **P** expresses clearance in the bearings.



6. Return the machine to the posture in Item 2 above, and confirm reading of dial gauge **P** is zero.
   ★ If zero value is not indicated, repeat the steps in Items 3 through 5.

MEASURING AND ADJUSTING OIL PRESSURES IN WORK EQUIPMENT, TRAVEL, BOOM SWING, SWING, AND BLADE CIRCUITS

★ Measuring instruments for oil pressures in work equipment, travel, boom swing, swing, and blade circuits

Symbol		Part No.	Part name
G	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-101-5220	Nipple
		07002-11023	O-ring

MEASURING

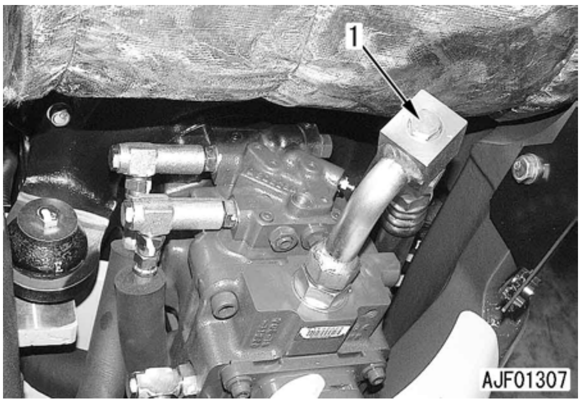
★ Hydraulic oil temperature for measurement: 45 – 55°C

⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank and set the safety lever in the LOCK position.

★ Remove the triangular cover from the left rear of the machine.

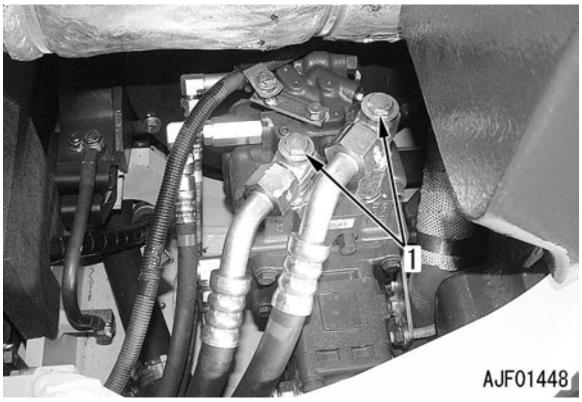
1. **Measuring oil pressures in work equipment, travel, and boom swing circuits**
   1) Remove main pump circuit oil pressure pick-up plug (1).
      ★ You may remove either plug from PC35, 40, 50MR-2.

   PC27, 30MR-2



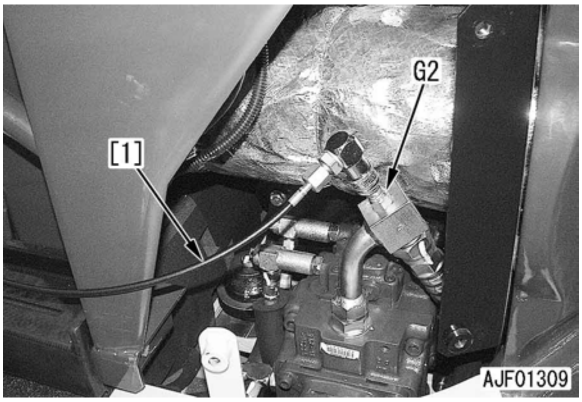
PC35MR-2

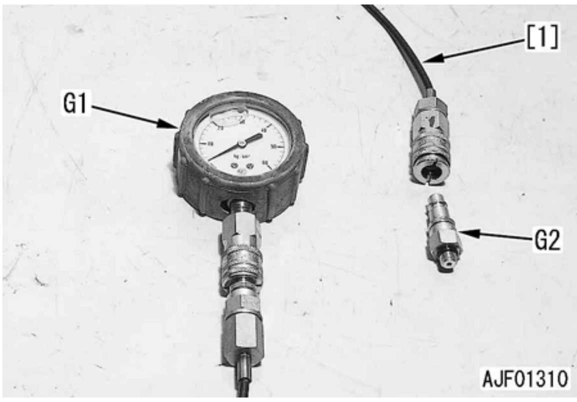
PC40, 50MR-2



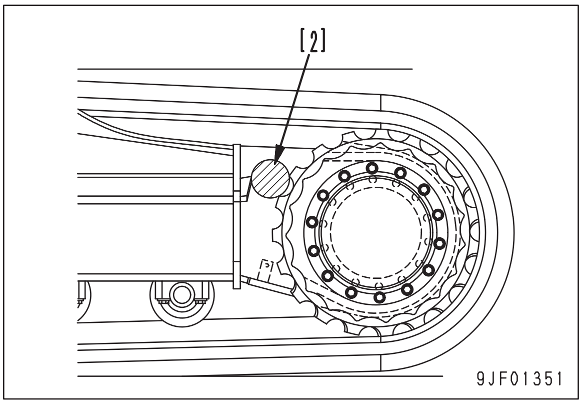
   2) Install nipple **G2** and connect oil pressure gauge **G1** (39.2 MPa {400 kg/cm^2}) by hose [1].

Example of PC27, 30MR-2





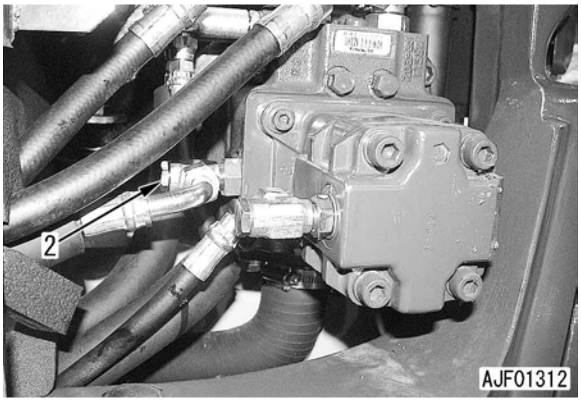
3) Measuring relief pressure
Start the engine, operate the actuator of the circuit to be measured, and measure the relief pressure.
   - Set the actuator to be measured as explained below.
   1] Work equipment and boom swing:
   Set each cylinder to the stroke end.
   2] Travel:
   Put block [2] between the sprocket and track frame to lock the travel motor.
4) Measuring unload oil pressure
Set all the control levers in neutral, run engine at full throttle, and measure the oil pressure.



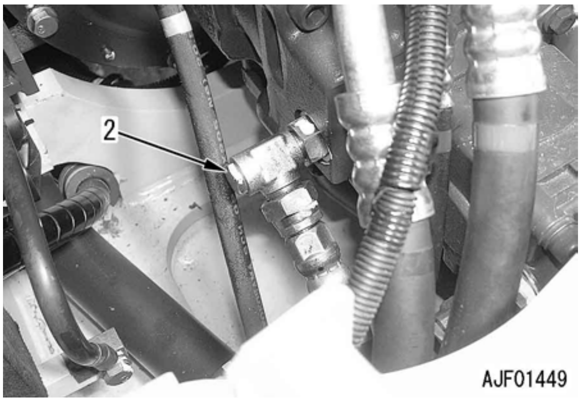
2. **Measuring oil pressures in swing and blade circuits**
   1) Remove the swing and blade circuit oil pressure pickup plug (2).

PC27, 30MR-2

PC35MR-2

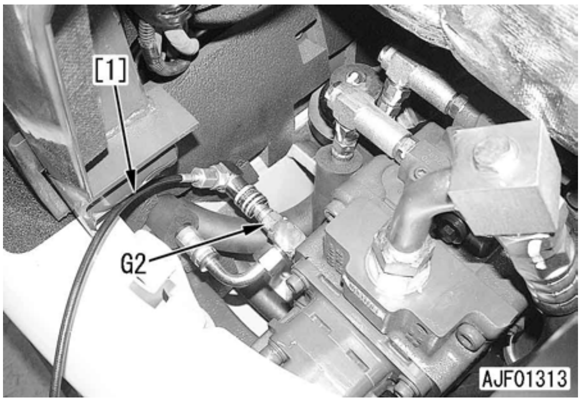


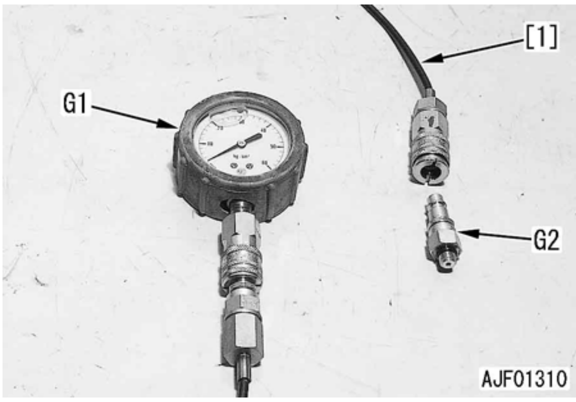
PC40, 50MR-2



2) Install nipple **G2** and connect oil pressure gauge **G1** (39.2 MPa {400 kg/cm^2}) by hose [1].

Example of PC27, 30MR-2





3) Start the engine, operate the actuator of the circuit to be measured, and measure the relief pressure.
   - Set the actuator to be measured as explained below.
   1] Blade:
   Set the cylinder to the stroke end.
   2] Swing:
   Lock the swing motor.
   ⚠ Since a swing holding brake is not installed, lock the machine securely with the work equipment.
   ★ The set pressure of the safety valve of the swing motor is lower than that of the main relief valve. Accordingly, if the swing circuit is relieved, the set pressure of the safety valve is obtained.

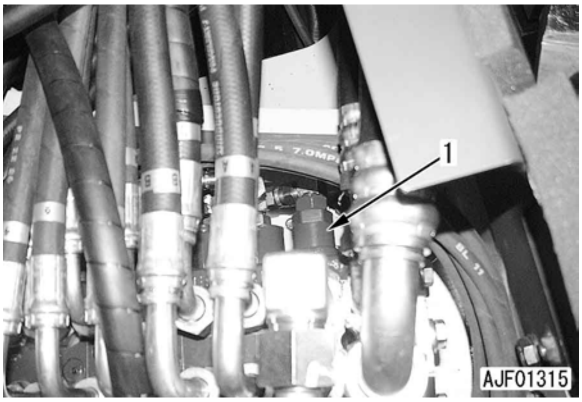
ADJUSTING

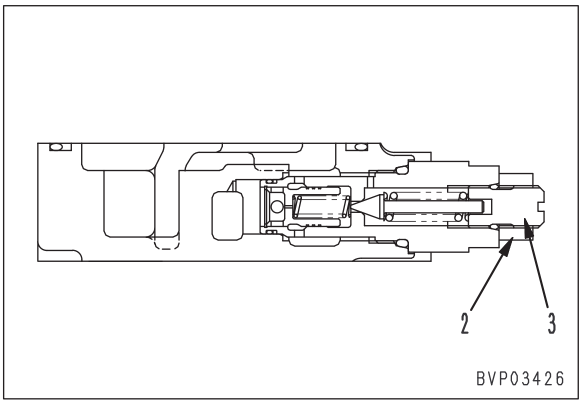
★ If any of the oil pressures in the work equipment, travel, boom swing, swing, and blade circuits is abnormal, adjust the corresponding valve according to the following procedure.
★ The unload valve cannot be adjusted.
★ Tilt up the floor frame.
For details, see How to open and close (tilt) floor.

1. Adjusting main relief valves of work equipment, travel, and boom swing circuits

- **Applicable model: PC27, 30MR-2**

1) Loosen locknut (2) of main relief valve (1) and turn adjustment screw (3).
   ★ If the adjustment screw is
   - Turned to the right, the pressure is increased.
   - Turned to the left, the pressure is decreased.
   ★ Amount of adjustment per turn of adjustment screw: 12.6 MPa {128 kg/cm^2}
2) After adjusting, tighten locknut (2).
   Locknut: **59 – 79 Nm {6 – 8 kgm}**
3) Referring to the section of measuring, check the relief pressure again.



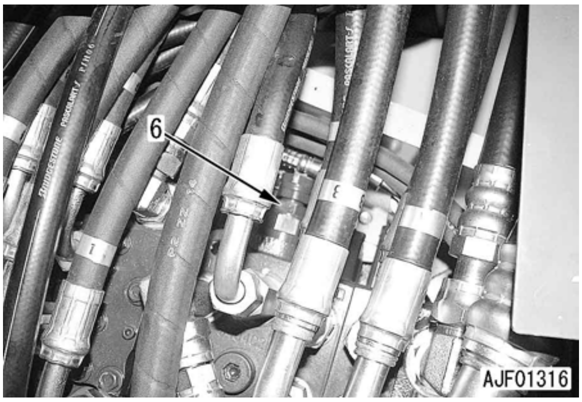


- **Applicable model: PC35, 40, 50MR-2**

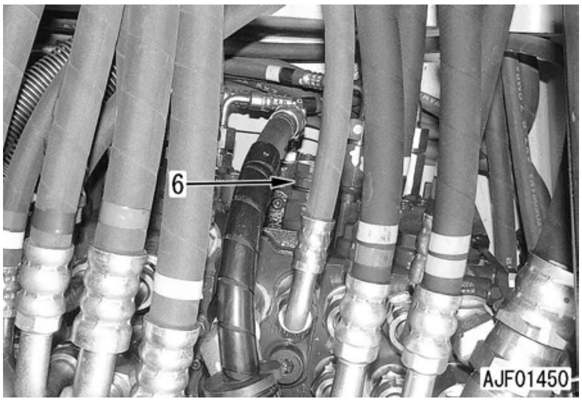
1) Loosen locknut (4) of main relief valve (6) and turn adjustment screw (5).
   ★ If the adjustment screw is
   - Turned to the right, the pressure is increased.
   - Turned to the left, the pressure is decreased.

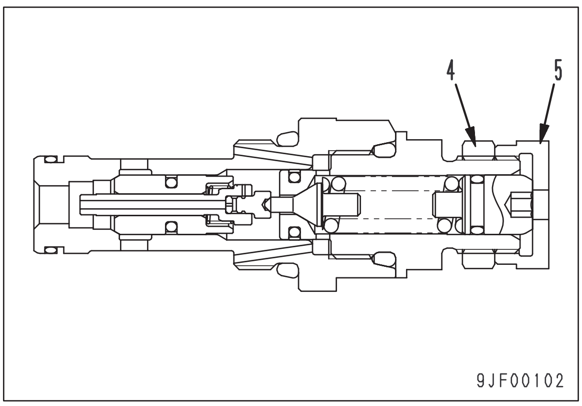
   ★ Amount of adjustment per turn of adjustment screw: 19.6 MPa {200 kg/cm^2}
2) After adjusting, tighten locknut (4).
   Locknut: **39 – 49 Nm {4 – 5 kgm}**
3) Referring to the section of measuring, check the relief pressure again.

PC35MR-2



PC40, 50MR-2





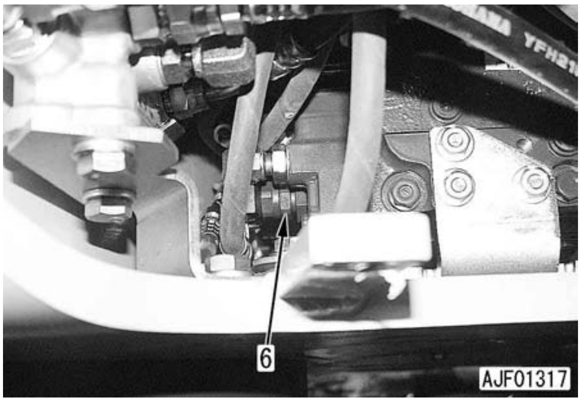
2. Adjusting main relief valves of swing and blade circuits

★ The set pressure of the safety valve of the swing motor is lower than that of the main relief valve. Accordingly, the relief pressure of only the blade circuit is obtained.

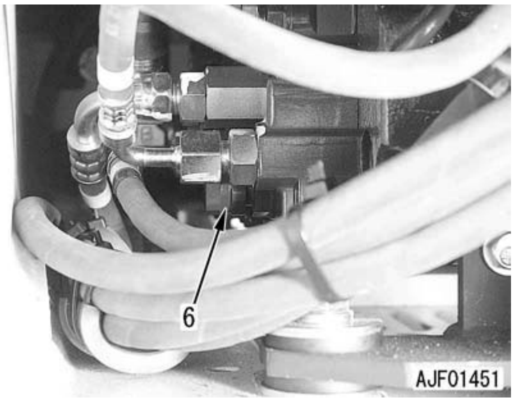
1) Loosen locknut (4) of relief valve (6) and turn adjustment screw (5).
   ★ If the adjustment screw is
   - Turned to the right, the pressure is increased.
   - Turned to the left, the pressure is decreased.

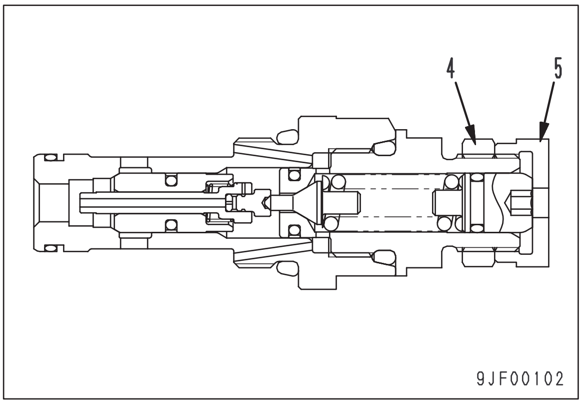
   ★ Amount of adjustment per turn of adjustment screw: 19.6 MPa {200 kg/cm^2}
2) After adjusting, tighten locknut (4).
   Locknut: **39 – 49 Nm {4 – 5 kgm}**
3) Referring to the section of measuring, check the relief pressure again.

PC27, 30, 35MR-2



PC40, 50MR-2





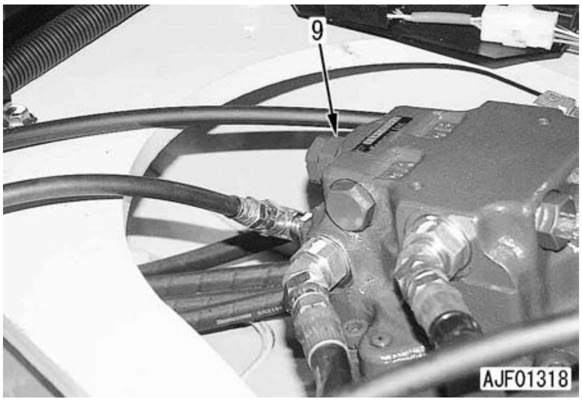
3. Adjusting safety valve of swing motor

★ If the swing relief pressure is abnormal, adjust the swing motor safety valve according to the following procedure.

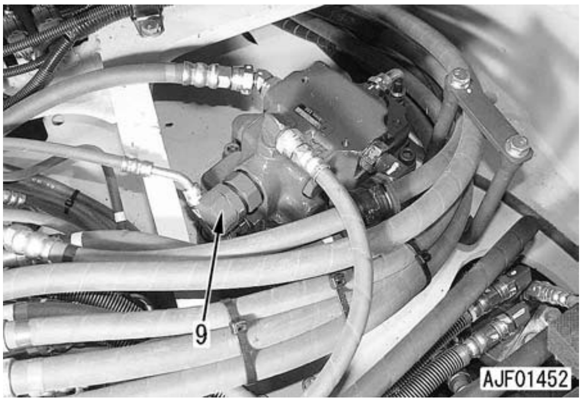
1) Loosen locknut (7) of swing motor safety valve (9) and turn adjustment screw (8).
   - ★ If the adjustment screw is
   - • Turned to the right, the pressure is increased.
   - • Turned to the left, the pressure is decreased.
   - ★ Amount of adjustment per turn of adjustment screw: 17.54 MPa {179 kg/cm^2}
2) After adjusting, tighten locknut (7).

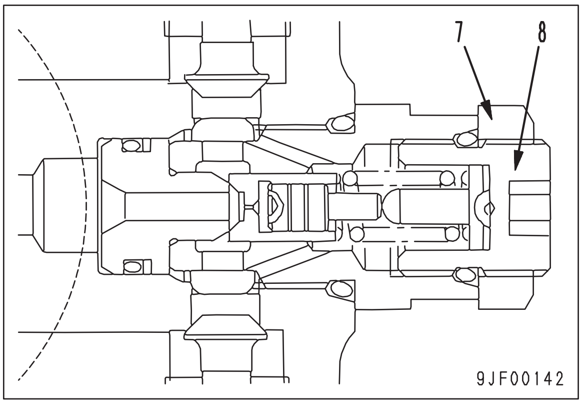
   Locknut:
   78.4 – 102.9 Nm {8 – 10.5 kgm}
3) Referring to the section of measuring, check the relief pressure again.

PC27, 30, 35MR-2



PC40, 50MR-2

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MEASURING AND ADJUSTING LS DIFFERENTIAL PRESSURE

★ Measuring instruments for LS differential pressure

Symbol		Part No.	Part name
H	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-101-5220	Nipple
		07002-11023	O-ring
	3	799-401-2701	Differential pressure gauge
	4	799-401-3100	Adapter
		02896-11008	O-ring
	5	799-401-3200	Adapter
		02896-11009	O-ring

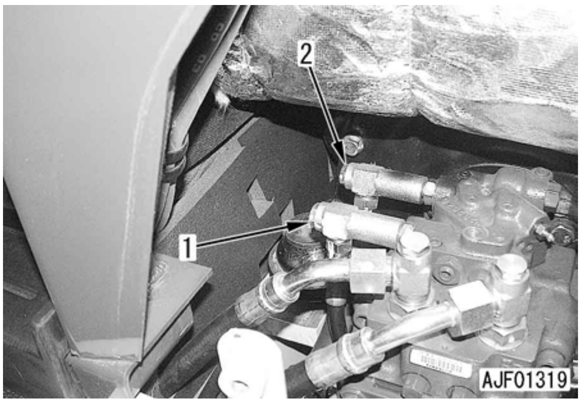
MEASURING

★ Remove the triangular cover from the left rear of the machine.

Measuring with differential pressure gauge
Applicable model: PC27, 30, 35MR-2

1. Remove oil pressure pickup plugs (1) and (2).
   PC27, 30MR-2

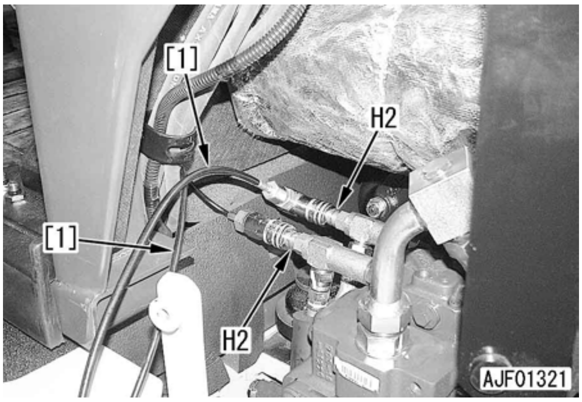
PC35MR-2

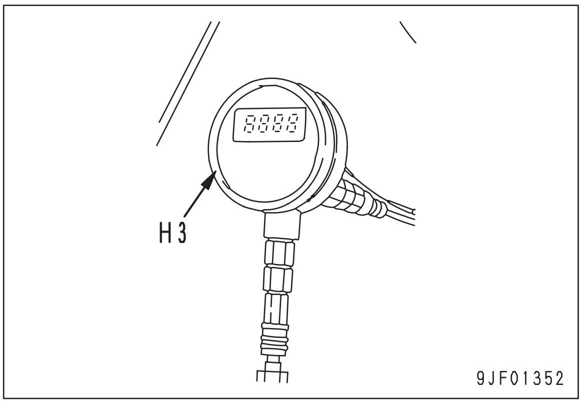


2. Install nipple **H2** and connect differential pressure gauge **H3** by hose [1]
   ★ Connect pump discharge pressure side (1) to the high pressure side of the differential pressure gauge and connect LS pressure side (2) to the low pressure side.

3. Run the engine at full throttle and measure the LS differential pressure under the following condition.
   ★ If the LS differential pressure is as follows, it is normal.

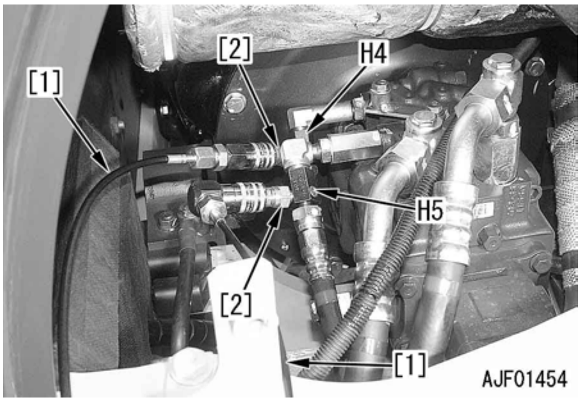
Operation of lever	LS differential pressure
Set all levers in neutral	Unload pressure (See standard values table)
Curl bucket (Move bucket lever to stroke end)	Specified LS differential pressure (See standard values table)





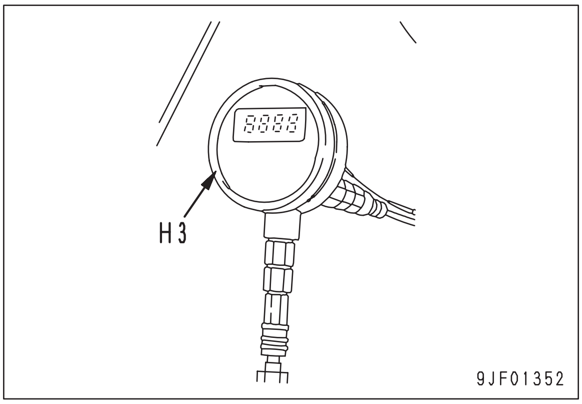
Applicable model: PC40, 50MR-2

1. Disconnect hydraulic hoses (3) and (4).



2. Install adapters **H4** and **H5** to the discharge side of the pump and LS pressure side respectively.

3. Install nipples [2] of oil pressure gauge kit **H1** to **H4** and **H5** and connect differential pressure gauge **H3** by hoses [1].
   ★ Connect the discharge side of the pump to the high-pressure side of the differential pressure gauge and connect the LS pressure side to the low-pressure side of the differential pressure gauge by hoses [1].



4. Run the engine at full throttle and measure the LS differential pressure under the following condition.
   ★ If the LS differential pressure is as follows, it is normal.

Operation of lever	LS differential pressure
Set all levers in neutral	Unload pressure (See standard values table)
Curl bucket (Move bucket lever to stroke end)	Specified LS differential pressure (See standard values table)

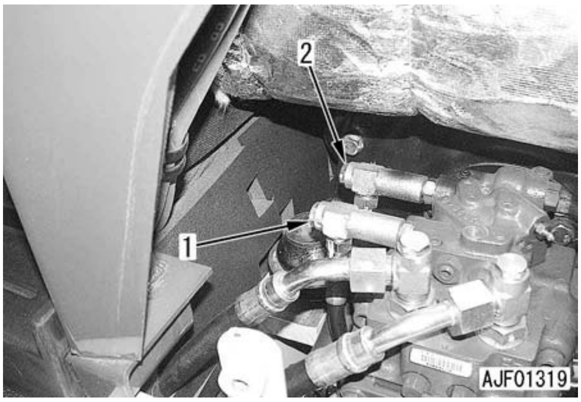
Measuring with oil pressure gauge

★ Since the differential pressure is 1.96 MPa {20 kg/cm^2} at maximum, measure it with the same oil pressure gauges.

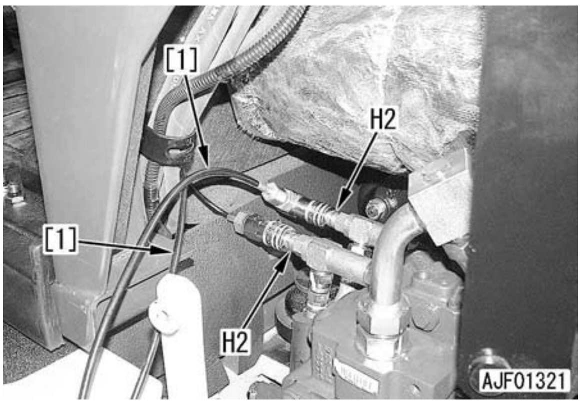
Applicable model: PC27, 30, 35MR-2

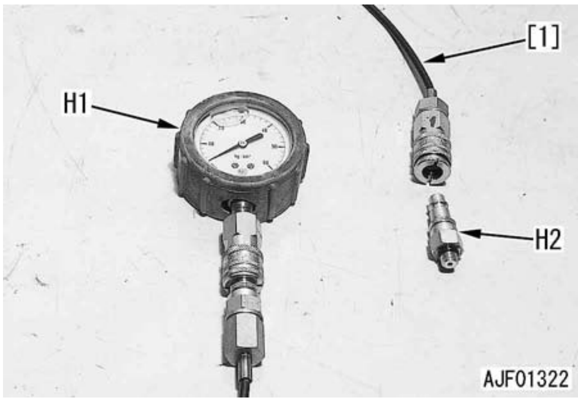
1. Remove oil pressure pickup plugs (1) and (2).
   PC27, 30MR-2

PC35MR-2



2. Install nipple **H2** and connect oil pressure gauge **H1** (39.2 MPa {400 kg/cm^2}) by hose [1].
   ★ Use oil pressure gauges having minimum divisions of 0.98 MPa {10 kg/cm^2}.





3. Run the engine at full throttle and measure the pump discharge pressure under the condition for measuring with the differential pressure gauge.
   ★ Read the gauge pointer accurately from the front side of the gauge.

4. Run the engine at full throttle and measure the LS pressure under the condition for measuring with the differential pressure gauge.
   ★ Read the gauge pointer accurately from the front side of the gauge.

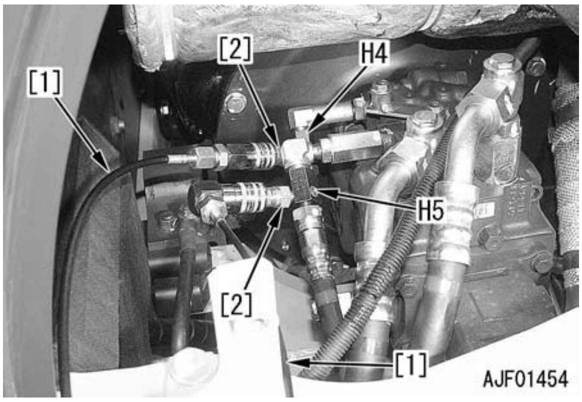
5. Calculate the LS differential pressure from the pump discharge pressure and LS pressure.
   ★ LS differential pressure = Pump discharge pressure - LS pressure

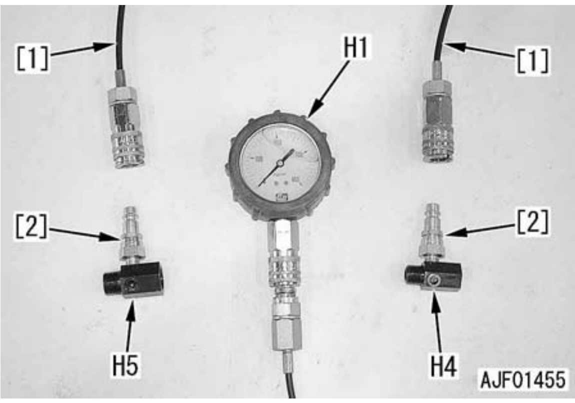
Applicable model: PC40, 50MR-2

1. Disconnect hydraulic hoses (3) and (4).

2. Install adapters **H4** and **H5** to the discharge side of the pump and LS pressure side respectively.

3. Install nipples [2] of oil pressure gauge kit **H1** to **H4** and **H5** and connect pressure gauge **H1** (39.2 MPa {400 kg/cm^2}) by hoses [1].
   ★ Use a pressure gauge having divisions of 0.98 MPa {10 kg/cm^2}.





4. Run the engine at full throttle and measure the pump discharge pressure under the condition for measurement with the differential pressure gauge.
   ★ Read the pointer accurately from its front side.

5. Run the engine at full throttle and measure the LS pressure under the condition for measurement with the differential pressure gauge.
   ★ Read the pointer accurately from its front side.

6. Calculate the LS differential pressure from the pump discharge pressure and LS pressure.
   ★ LS differential pressure = Pump discharge pressure – LS pressure

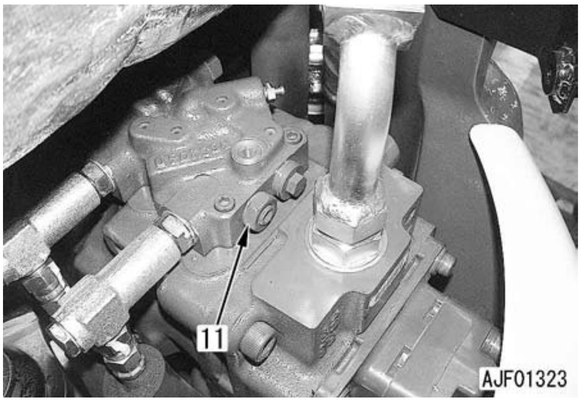
ADJUSTING

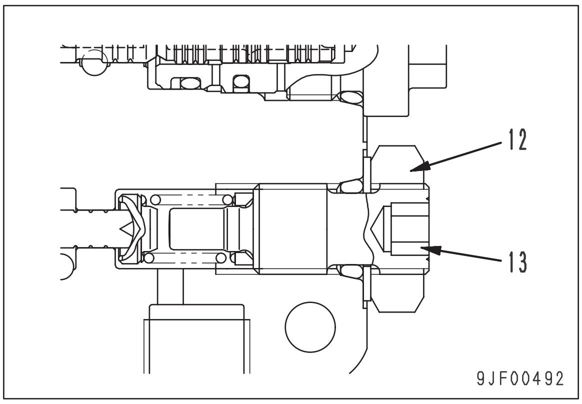
★ If the LS differential pressure is abnormal, adjust the LS valve according to the above procedure.

1. Loosen locknut (12) of LS valve (11) and turn adjustment screw (13).
   ★ If the adjustment screw is
   • Turned to the right, the pressure is increased.
   • Turned to the left, the pressure is decreased.

2. After adjusting, tighten locknut (12).
   Locknut: **27.4 – 34.3 Nm {2.8 – 3.5 kgm}**

3. Referring to the section of measuring, check the LS differential pressure again.
   Example of PC27, 30MR-2



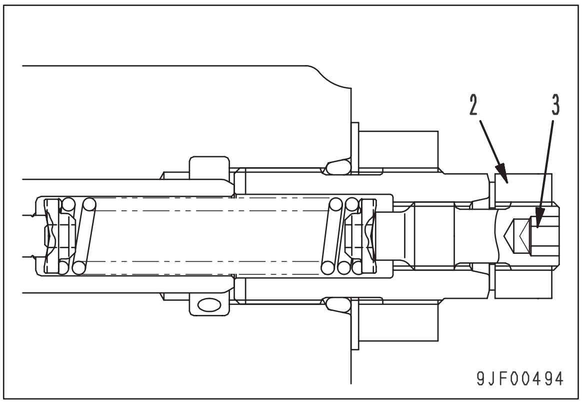


ADJUSTING PC VALVE

★ While the pump discharge pressure and LS differential pressure are normal, if the following faults occur, adjust the PC valve.

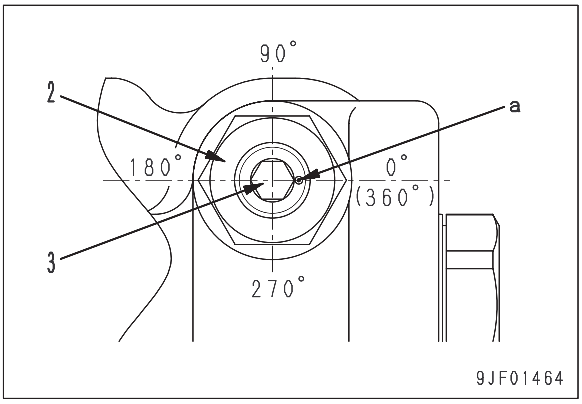
- When the load is increased, the engine speed lowers.
- The engine speed is normal but the work equipment speed is low.

★ The PC valve is installed in the servo piston.



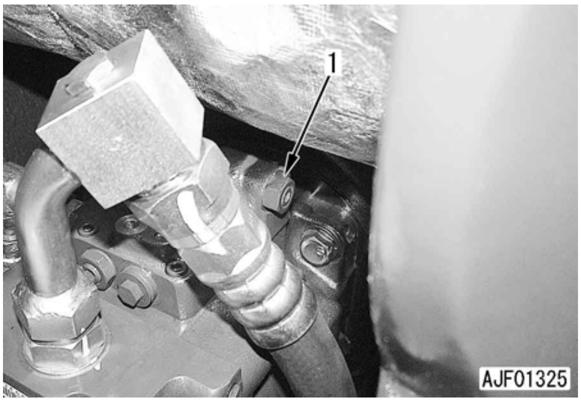
1. Loosen locknut (2) of PC valve (1) and turn adjustment screw (3).
   ★ Turn the adjustment screw as explained below.
   - If the engine speed lowers:
     turn the adjustment screw to the left (to reduce the pump absorption torque).
   - If the work equipment speed is low:
     turn the adjustment screw to the right (to increase the pump absorption torque).

   ★ Limit the turning range of the adjustment screw to 180 degrees in either direction.
   ★ **a** in the figure shows the position at the time of assembly.



2. After adjusting, tighten locknut (2).
   Locknut: **27.4 – 34.4 Nm {2.8 – 3.5 kgm}**

Example of PC27, 30MR-2

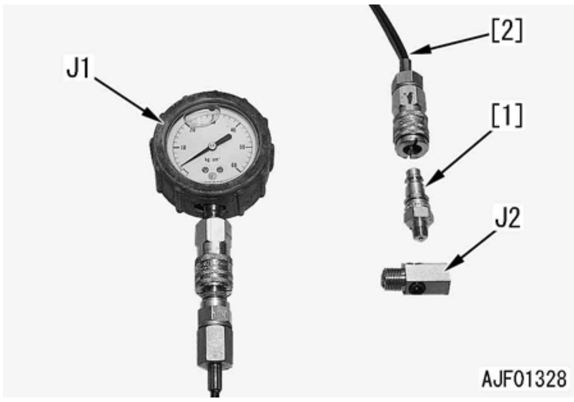


MEASURING CONTROL CIRCUIT OIL PRESSURE (OIL PRESSURE REDUCED BY SELF PRESSURE)

Applicable model: PC27, 30MR-2

★ Measuring instruments for control circuit oil pressure

Symbol		Part No.	Part name
J	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-401-3100	Adapter
		02896-11008	O-ring



MEASURING

★ Hydraulic oil temperature for measurement: 45 – 55°C

⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank and set the safety lever in the LOCK position.

1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

2. Disconnect hose (1) between the control valve and solenoid valve, install adapter **J2**, and install nipple [1] of oil pressure gauge kit **J1**.

3. Connect oil pressure gauge **J1** (5.9 MPa {60 kg/cm^2}) by hydraulic hose [2].

4. Tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

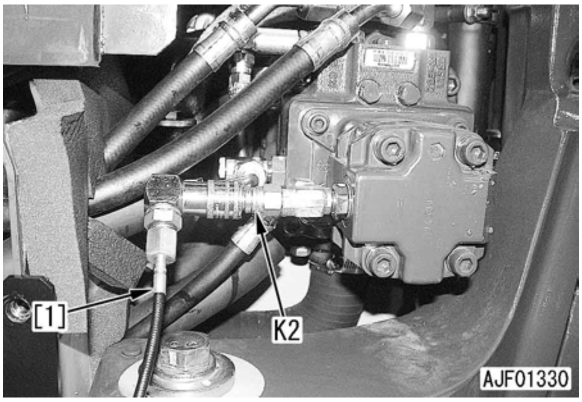
5. Run the engine at full throttle, set the control lever in neutral, and measure the circuit oil pressure.

MEASURING AND ADJUSTING CONTROL PUMP CIRCUIT OIL PRESSURE

Applicable model: PC35, 40, 50MR-2

★ Measuring instruments for control pump circuit oil pressure

Symbol		Part No.	Part name
K	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-101-5220	Nipple
		07002-11023	O-ring

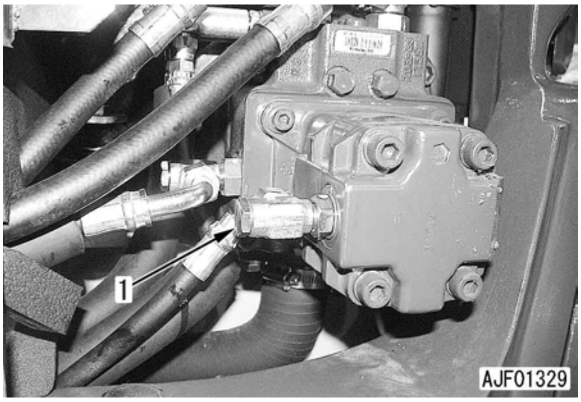


MEASURING

★ Hydraulic oil temperature for measurement: 45 – 55°C

★ Remove the triangular cover from the left rear of the machine.

1. Remove oil pressure pickup plug (1) of the control pump outlet hose.



2. Install nipple **K2** and connect hose [1] to oil pressure gauge **K1** (5.9 MPa {60 kg/cm^2}).

3. Run the engine at full throttle, set the control lever in neutral, and measure the circuit oil pressure.

ADJUSTING

★ If the control circuit oil pressure is abnormal, adjust control relief valve according to the following procedure.

★ Tilt up the floor frame.
For details, see How to open and close (tilt) floor.

1. Loosen locknut (3) of relief valve (2) and turn adjustment screw (4).
   ★ If the adjustment screw is
   - Turned to the right, the pressure is increased.
   - Turned to the left, the pressure is decreased.

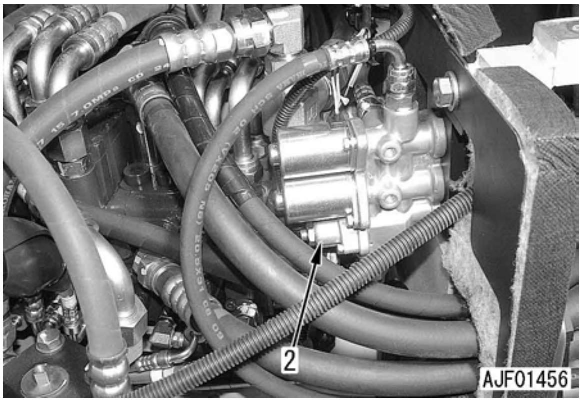
   ★ Amount of adjustment per turn of adjustment screw: 0.92 MPa {9.4 kg/cm^2}

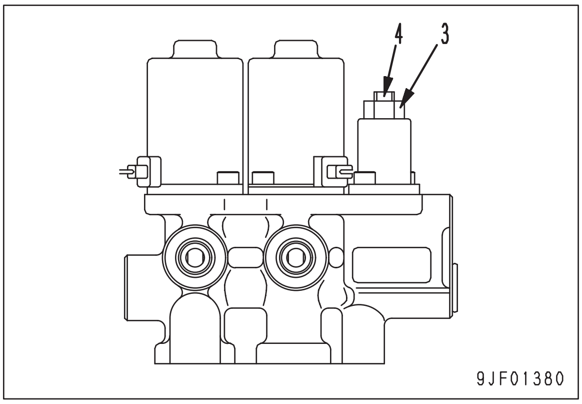
2. After adjusting, tighten locknut (3).

   Locknut: **9.8 Nm {1.0 kgm}**

PC35MR-2

PC40, 50MR-2





3. Tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

4. Referring to the section of measuring, check the pressure again.

MEASURING SOLENOID VALVE OUTPUT PRESSURE

★ Measuring instruments for solenoid valve output pressure

Symbol		Part No.	Part name
L	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-401-3100	Adapter
		02896-11008	O-ring

MEASURING

★ Hydraulic oil temperature for measurement: 45 – 55°C

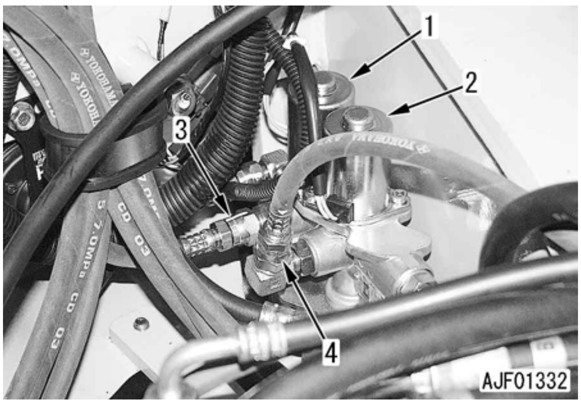
★ Measure the pressure at the outlet of each solenoid valve.

No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	2nd travel speed selection solenoid valve

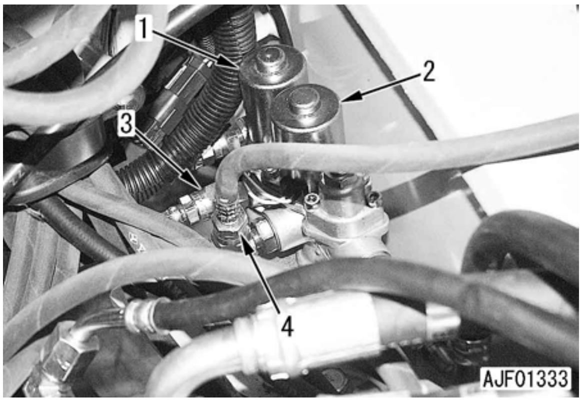
1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

2. Disconnect outlet hose (3) or (4) of the solenoid valve to be measured and install adapter **L2**, then install nipple [1] of oil pressure gauge kit **L1** to adapter **L2**.
   ★ Hose (3) is on the PPC lock solenoid side and (4) is on 2nd travel speed selection solenoid side.

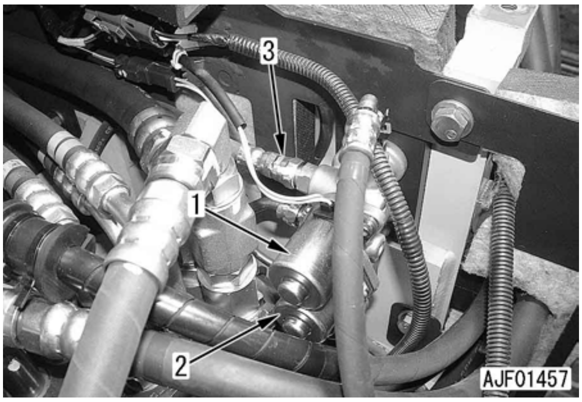
3. Connect oil pressure gauge **L1** (5.9 MPa {60 kg/cm^2}) by hydraulic hose [2].
   PC27, 30MR-2



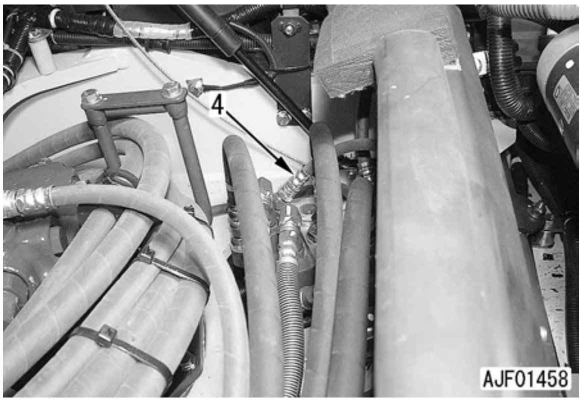
PC35MR-2

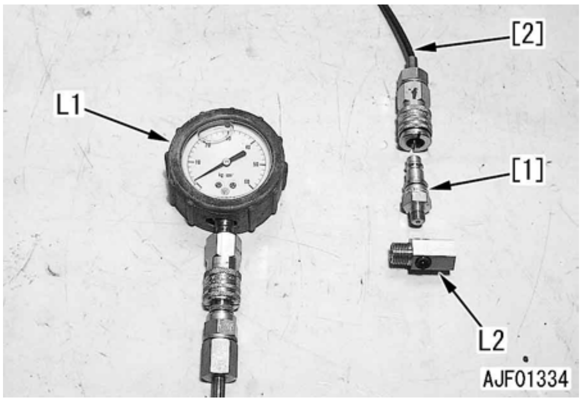


PC40, 50MR-2



PC40, 50MR-2





4. Tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

5. Run the engine at full throttle and measure the output pressure under the following conditions.

- **PC27, 30, 35MR-2**

No.	Solenoid valve	Measurement conditions	Operation of solenoid	Oil pressure (MPa{kg/cm^2})
1	PPC lock	Lock lever: LOCK	OFF	0{0}
		Lock lever: FREE	ON	$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$
2	2nd travel speed selection	2nd travel speed selection pedal: OFF	OFF	0{0}
		2nd travel speed selection pedal: ON	ON	$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$

- **PC40, 50MR-2**

No.	Solenoid valve	Measurement conditions	Operation of solenoid	Oil pressure (MPa{kg/cm^2})
1	PPC lock	Lock lever: LOCK	OFF	0{0}
		Lock lever: FREE	ON	$3.33^{+0.29}_{0}$ $\{34^{+3}_{0}\}$
2	2nd travel speed selection	2nd travel speed selection pedal: OFF	OFF	0{0}
		2nd travel speed selection pedal: ON	ON	$3.72^{+0.39}_{-0.1}$ $\{38^{+4}_{-1}\}$

MEASURING PPC VALVE OUTPUT PRESSURE

★ Measuring instruments for PPC valve output pressure

Symbol		Part No.	Part name
M	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-401-3100	Adapter
		02896-11008	O-ring

MEASURING

★ Measure the PPC valve output pressure when the work equipment speed or swing speed is low or the work equipment does not move.

★ Hydraulic oil temperature for measurement: 45 – 55°C

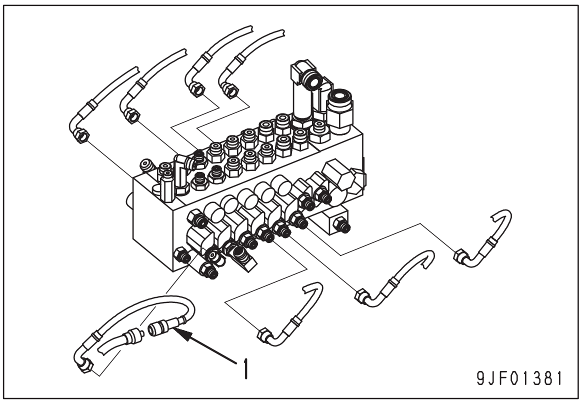
1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

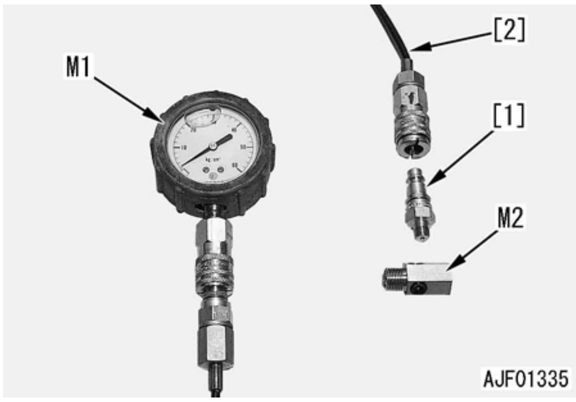
2. Disconnect PPC hose (1) of the circuit to be measured from the PPC valve or control valve, install adapter **M2**, and install nipple [1] of oil pressure gauge kit **M1**.

3. Connect oil pressure gauge **M1** (5.9 MPa {60 kg/cm^2} by hydraulic hose [2].

4. Tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

5. Run the engine at full throttle, operate the lever (pedal) of the circuit to be measured, and measure the PPC valve output pressure.

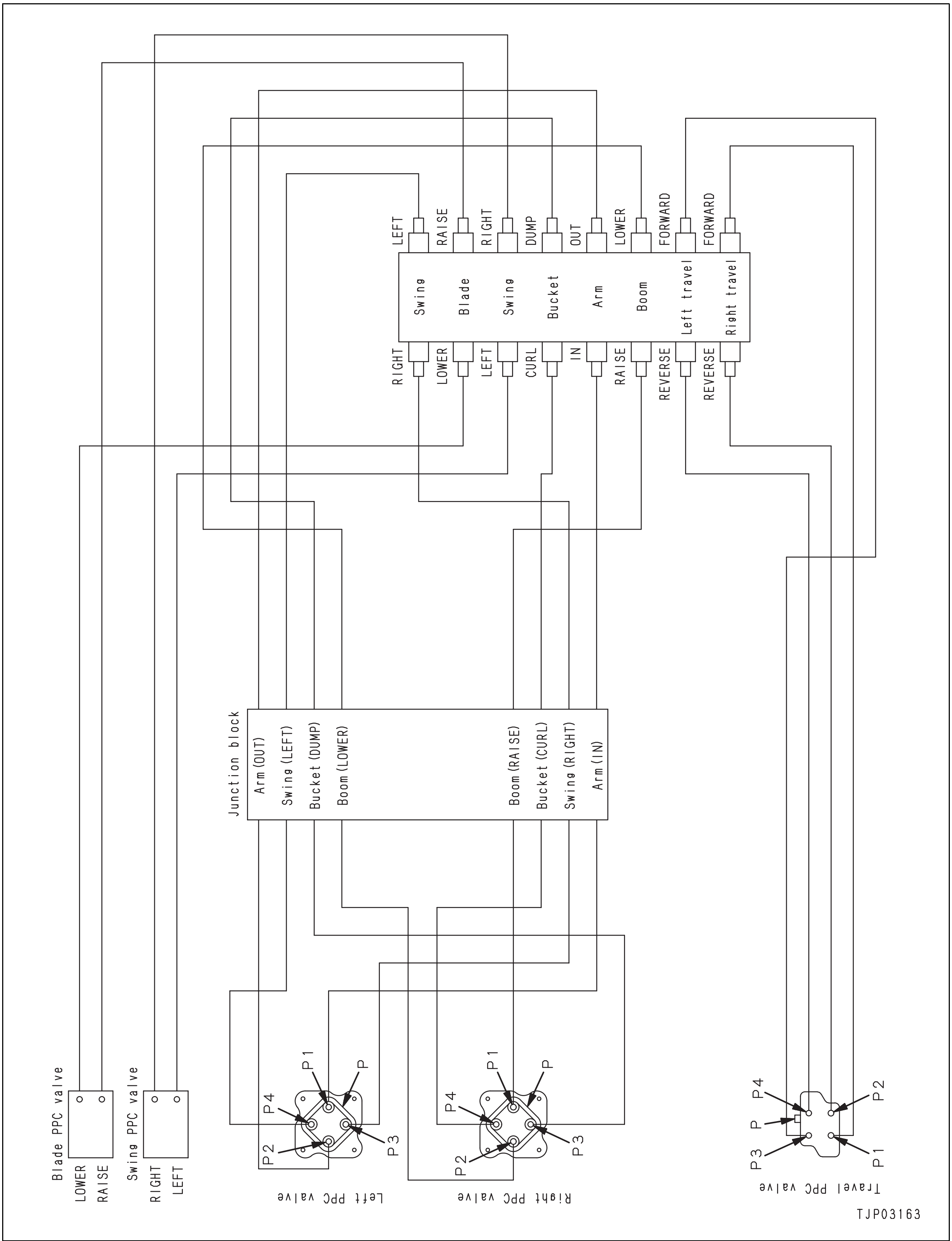




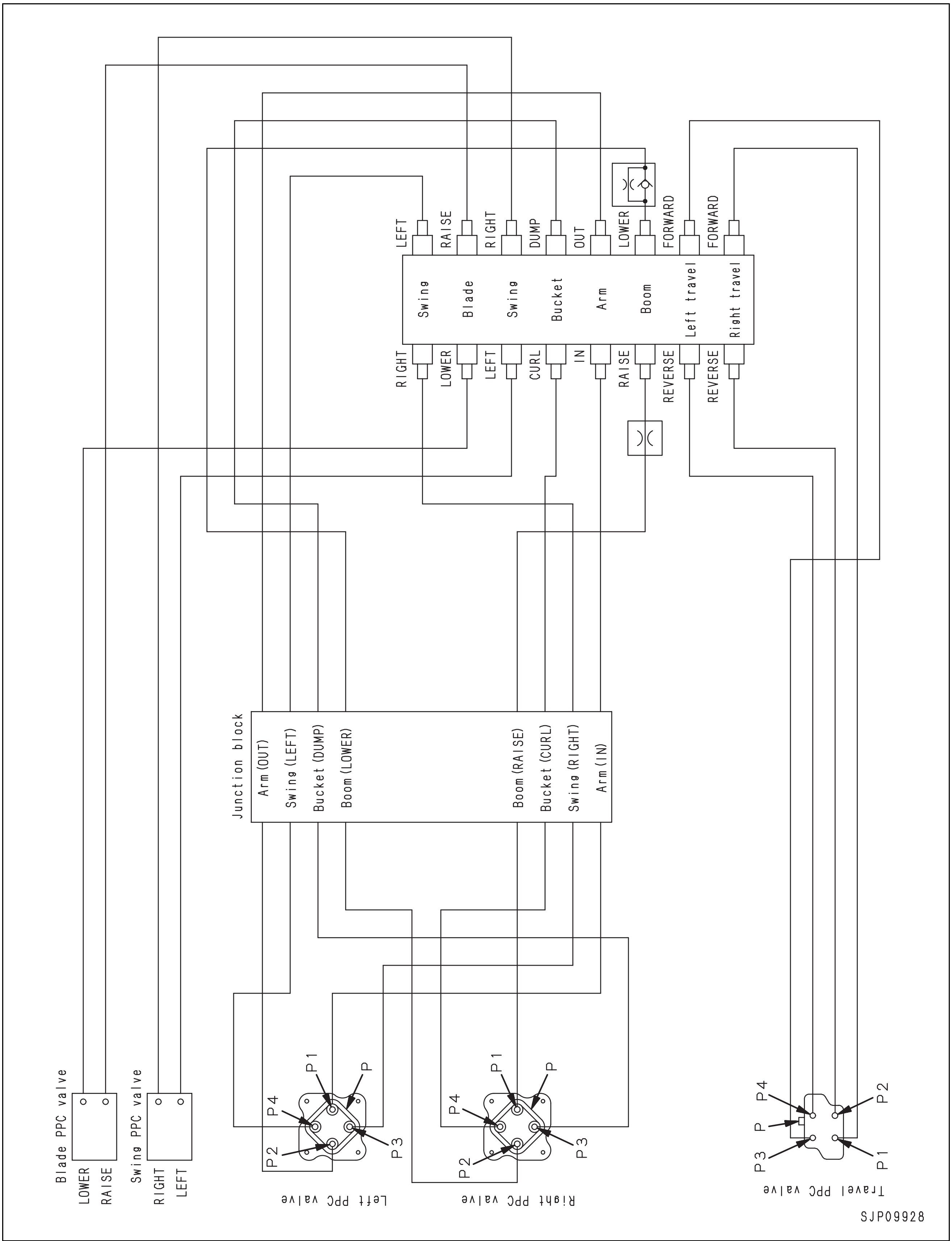
★ The connection diagram of the PPC valve and control valve is shown on the next page.

CONNECTION DIAGRAM OF PPC VALVE AND CONTROL VALVE

- **P27MR-2**

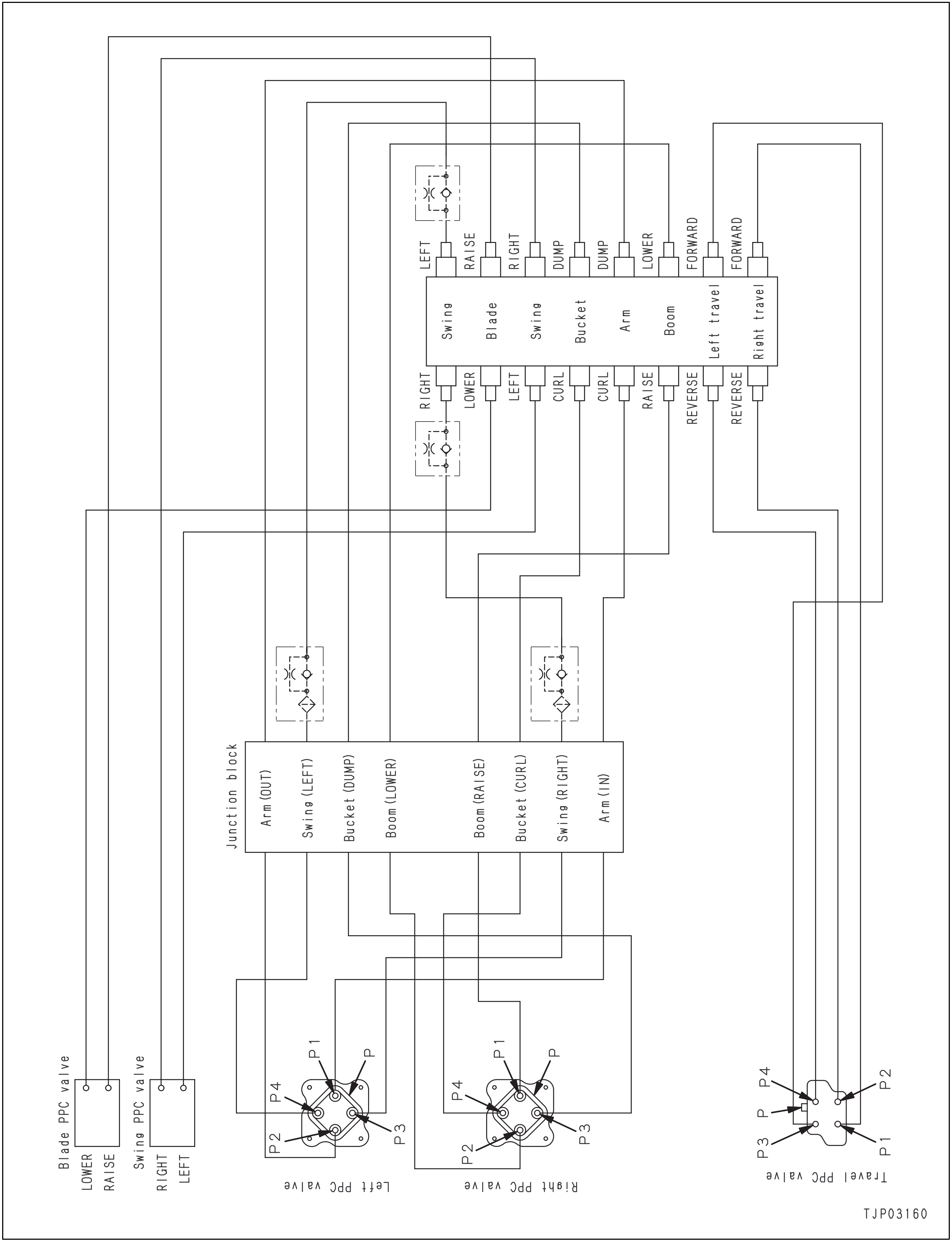


- **PC30, 35MR-2**



Swing
Blade
Bucket
Arm
Boom
Left travel
Right travel
LEFT
RAISE
RIGHT
DUMP
OUT
LOWER
FORWARD
LOWER
LEFT
CURL
IN
RAISE
REVERSE
Junction block
Arm (OUT)
Swing (LEFT)
Bucket (DUMP)
Boom (LOWER)
Boom (RAISE)
Bucket (CURL)
Swing (RIGHT)
Arm (IN)
Blade PPC valve
Swing PPC valve
Left PPC valve
Right PPC valve
Travel PPC valve
P
P1
P2
P3
P4
SJP09928

- **PC40, 50MR-2**

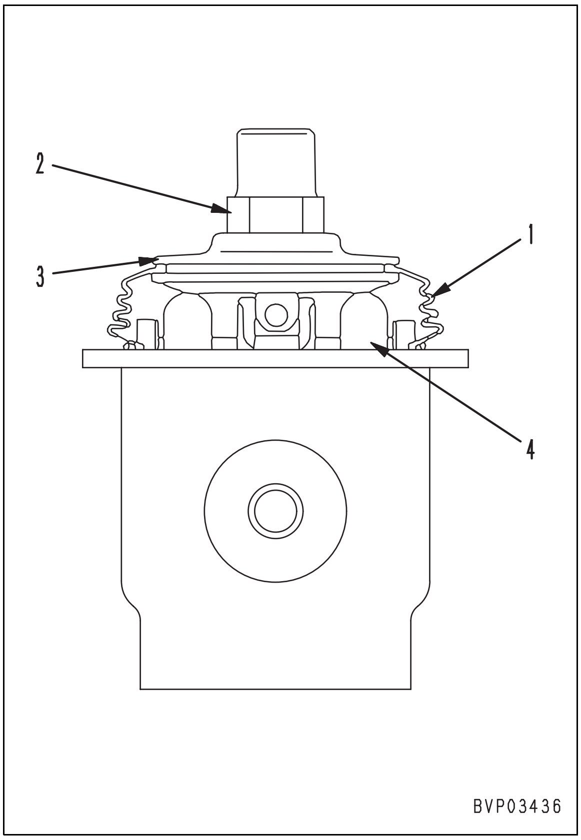

LEFT
RAISE
RIGHT
DUMP
DUMP
LOWER
FORWARD
FORWARD
Swing
Blade
Swing
Bucket
Arm
Boom
Left travel
Right travel
RIGHT
LOWER
LEFT
CURL
CURL
RAISE
REVERSE
REVERSE
Junction block
Arm (OUT)
Swing (LEFT)
Bucket (DUMP)
Boom (LOWER)
Boom (RAISE)
Bucket (CURL)
Swing (RIGHT)
Arm (IN)
Blade PPC valve
LOWER
RAISE
Swing PPC valve
RIGHT
LEFT
Left PPC valve
Right PPC valve
Travel PPC valve
TJP03160

ADJUSTING PPC VALVE

★ If the work equipment/swing control lever has excessive play, adjust it according to the following procedure.

⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank and set the safety lever in the LOCK position.

1. Remove the PPC valve
2. Remove boot (1).
3. Loosen locknut (2) and screw in disc (3) until it touches the heads of 4 pistons (4).
   ★ At this time, do not move the pistons.
4. Fix disc (3) and tighten locknut (2) to the specified torque.
   Locknut: **107.9 ± 9.8 Nm {11 ± 1 kgm}**
5. Install boot (1).
   ★ After the above adjustment, clearance between disc (3) and piston (4) is eliminated.



MEASURING SWING HOLDING BRAKE RELEASE PRESSURE

★ Measuring instruments for swing holding brake release pressure

Symbol		Part No.	Part name
M	1	799-101-5002	Oil pressure gauge kit (Analog)
		790-261-1204	Oil pressure gauge kit (Digital)
	2	799-401-3100	Adapter
		02896-11008	O-ring

MEASURING

★ Hydraulic oil temperature for measurement: 45 – 55°C

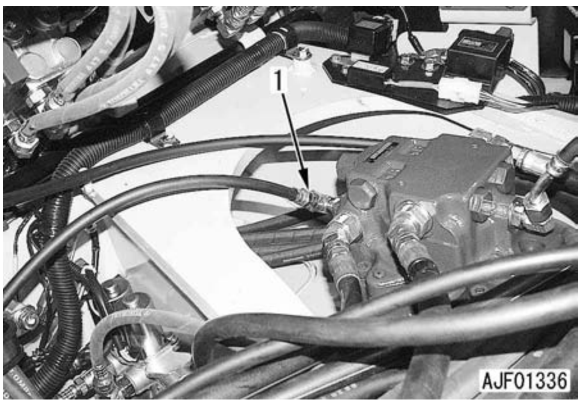
1. Tilt up the floor frame.
   For details, see How to open and close (tilt) floor.

2. Disconnect swing motor inlet hose (1), install adapter **M2**, and install nipple [1] of oil pressure gauge kit **M1**.

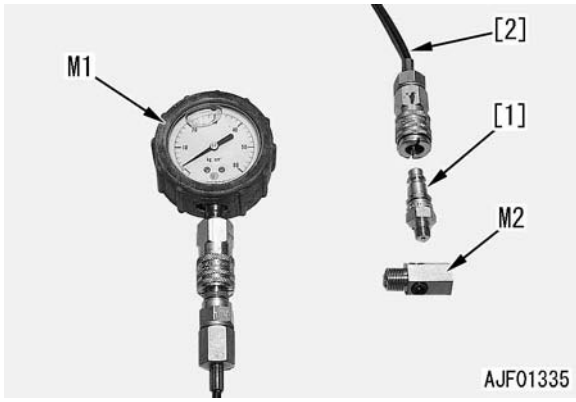
3. Connect oil pressure gauge **M1** (5.9 MPa {60 kg/cm^2} by hydraulic hose [2].

4. Tilt down the floor frame.
   For details, see How to open and close (tilt) floor.

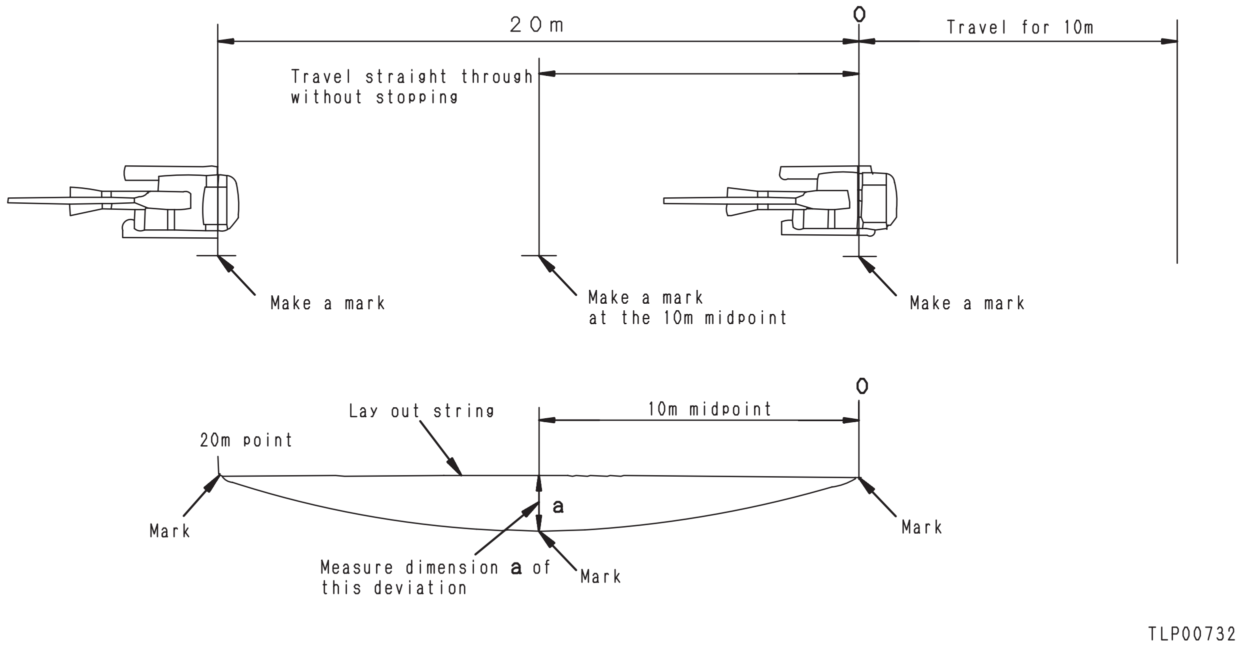
5. Run the engine at full throttle, swing to right or left or move the arm IN, and measure the swing holding brake release pressure.
   PC27, 30, 35MR-2



PC40, 50MR-2

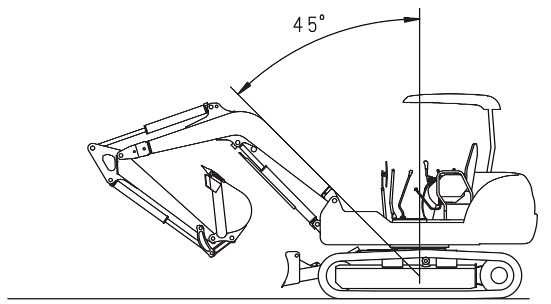


TESTING AND ADJUSTING TRAVEL DEVIATION



TESTING

1. Set the machine to the travel posture.
   ★ Extend the bucket cylinder and arm cylinder to the stroke end and set the boom angle to 45 degrees.



2. After approach run of 10 m, measure travel deviation (a) in the travel of 20 m after approach run.
   ★ Keep running the engine at full throttle.
   ★ Install an oil pressure gauge and measure the hydraulic pump discharge pressure, too.

ADJUSTING

Note) Do not perform the following procedure for PC27, 30MR-2.

★ If the machine deviates, it can be corrected by partially draining the oil discharged more from the pump through the adjustment plug. (If the travel deviation is corrected by this method, however, the pump discharge is reduced. As a result, the travel speed, work equipment speed in compound operation, and relief pressure may lower.)

★ If the machine deviates in the same direction regardless of the travel direction, correct it according to the following procedure.

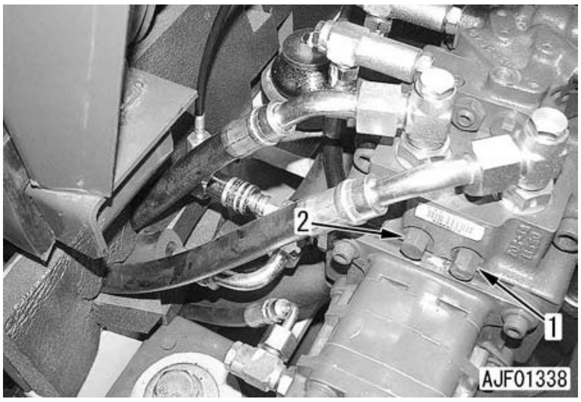
★ Only when the travel deviation is 200 mm or less, it can be corrected by the following method.

⚠ If the adjustment plug is loosened more than the adjustment limit, high-pressure oil will spout out. Take care extremely.

⚠ Lower the work equipment to the ground and stop the engine. Loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.

1. Check the locations of adjustment plugs (1) and (2) of the main pump.
   - (1): Right deviation adjustment plug
   - (2): Left deviation adjustment plug

   Example of PC35MR-2



2. Insert hexagonal wrench (width across flats: 4 mm) in adjustment plug (1) or (2).
   ★ Insert the hexagonal wrench securely.

3. Fix the hexagonal wrench and loosen locknut (3).
   ★ Before loosening the locknut, make match marks on it and pump case to check its turning angle.
   - Loosening angle of locknut: 90 – 180 degrees

4. Loosen adjustment plug (1) or (2) to adjust the travel deviation.
   - Amount of adjustment per turn of adjustment plug: 150 mm (Reference)

   ★ The plug is fully tightened when shipped. Adjust the deviation by the loosening angle of the plug from the fully tightened position.
   ★ When the locknut is loosened, if the adjustment plug is dragged, tighten the adjustment plug fully, and then adjust it again.

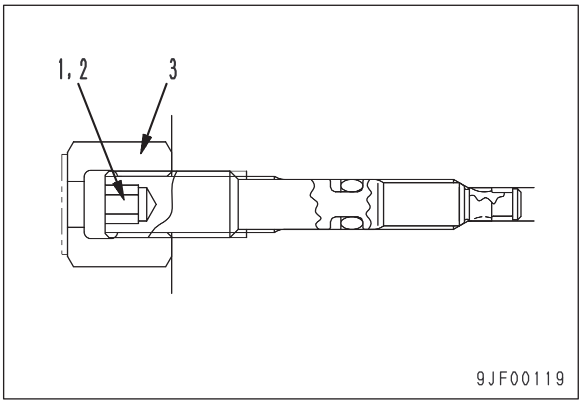
   Adjustment plug:
   2.94 – 4.9 Nm {0.3 – 0.5 kgm}

   ★ The adjustment plug can be loosened by 2 turns (720 degrees) from the fully tightened position.

5. Fix the adjustment plug with the hexagonal wrench and tighten locknut (3).

   Locknut: **11.8 – 14.7 Nm {1.2 – 1.5 kgm}**

6. Check the travel deviation again according the above described testing procedure. If it is not corrected completely, adjust it again.
   ★ Do not adjust more than the adjustment limit of the adjustment plug (2 turns/720 degrees).



MEASUREMENT OF OIL LEAKAGE FROM WORK EQUIPMENT CYLINDER

★ Measuring instruments for oil leakage from work equipment cylinder

Symbol	Part No.	Part name
N	Commercially available	Measuring cylinder

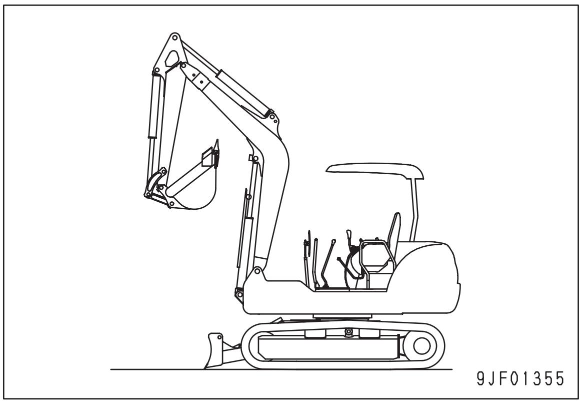
★ Hydraulic oil temperature for measurement: 45 – 55°C

★ If the hydraulic drift of the work equipment is out of the standard range, measure the leakage in the cylinder according to the following procedure to see if the cause of the hydraulic drift is on the control valve side.

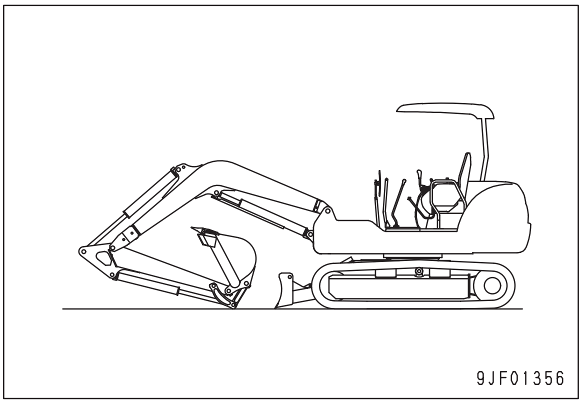
- If the leakage is within the standard range, the cause is on the cylinder side.

1. Fully extend the rod of the cylinder to be measured and stop the engine.

   Posture for measuring boom cylinder

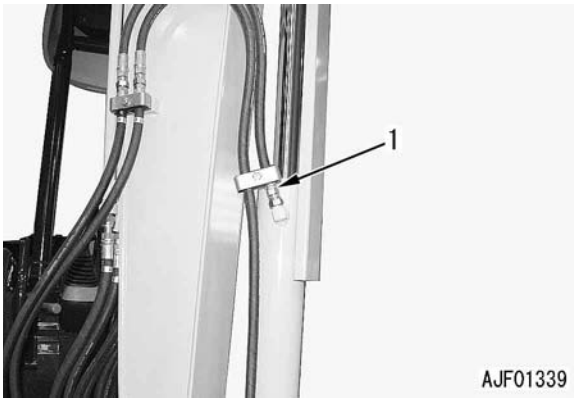


Posture for measuring arm cylinder and bucket cylinder

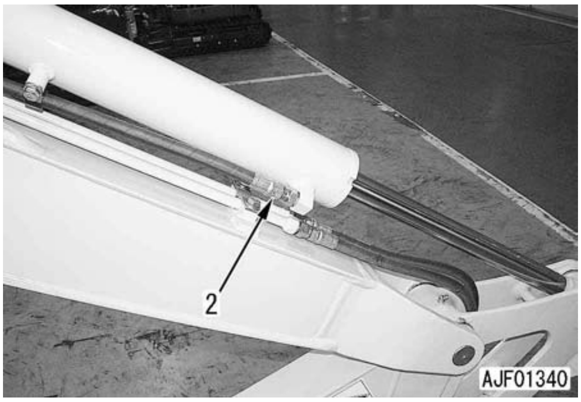


2. Disconnect the hose on the head side and plug the hose on the chassis side.
   - Hose (1): Boom cylinder
   - Hose (2): Arm cylinder
   - Hose (3): Bucket cylinder

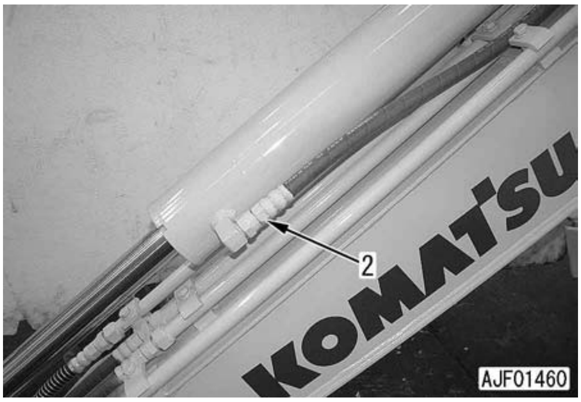
   ⚠ Take care not to disconnect the hose on the cylinder bottom side.

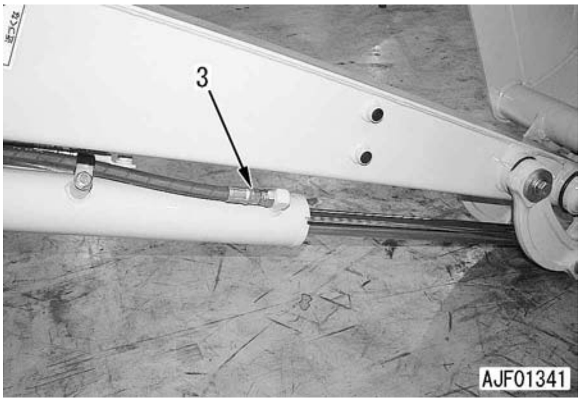


PC27, 30, 35MR-2



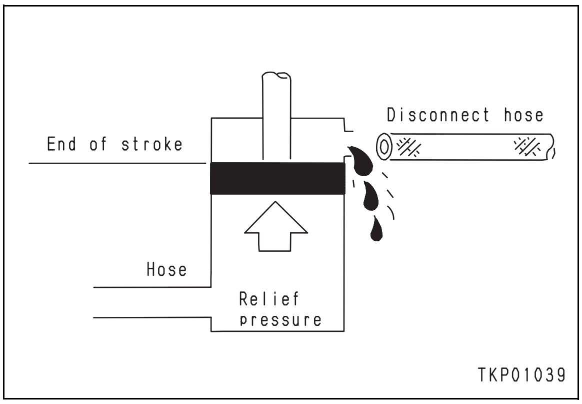
PC40, 50MR-2





3. Run the engine at full throttle and apply the relief pressure to the bottom side of the cylinder.
   ★ Boom cylinder: Operate to RAISE the boom.
   Arm cylinder: Operate to move the arm IN.
   Bucket cylinder:
   Operate to CURL the bucket.

4. Relieve the oil for 30 seconds, and then measure the oil leakage for 1 minute.



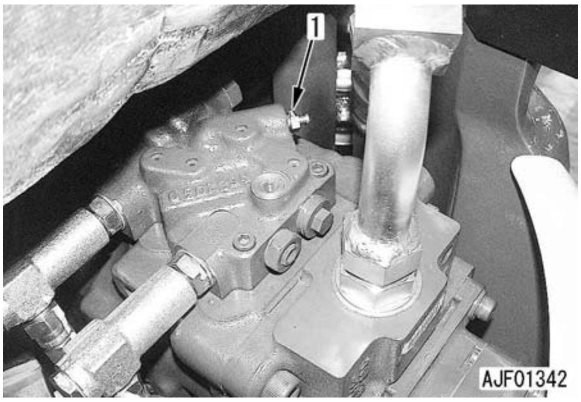
BLEEDING AIR FROM EACH PART

Air bleeding item / Contents of work	Air bleeding procedure						
	1	2	3	4	5	6	7
	Bleeding air from pump	Starting engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Pressurizing hydraulic tank	Starting operation
• Replacement of hydraulic oil • Cleaning strainer	○	○	○	○ (Note)	○ (Note)	○	○
• Replacement of return filter element		○				○	○
• Replacement or repair of pump • Removal of suction piping	○	○	○			○	○
• Replacement or repair of control valve		○	○			○	○
• Replacement or repair of cylinder • Removal of cylinder piping		○	○			○	○
• Replacement or repair of swing motor • Removal of swing motor piping		○		○		○	○
• Replacement or repair of travel motor and swivel • Removal of travel motor and swivel		○			○	○	○

Note: Bleed air from the swing motor and travel motor only after the oil in the motor cases is drained.

1. **Bleeding air from pump**
   ★ Remove the triangular cover from the left rear of the machine.
   1) Loosen air bleeder (1) to bleed air.
      ★ Bleed air until oil containing no air flows out.
   2) Tighten air bleeder (1).
      Air bleeder:
      8.8 ± 1 Nm {0.9 ± 0.1 kgm}
      ★ After the above work, run the engine at low idle for about 10 minutes.

PC27, 30MR-2

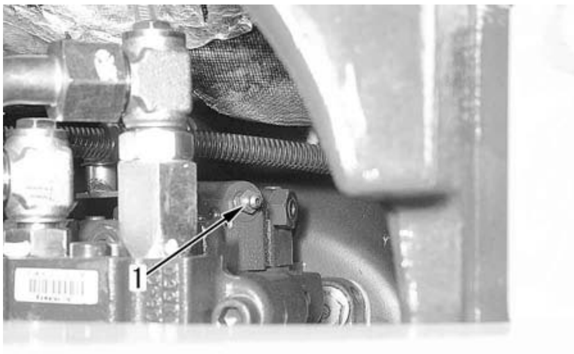


AJF01342

PC35MR-2

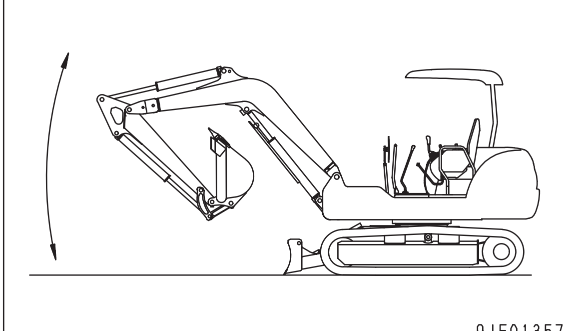
AJF01343

PC40, 50MR-2



AJF01461

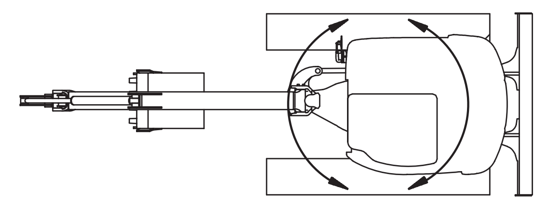
2. **Bleeding air from cylinder**
   1) Run the engine at low idle for about 5 minutes.
   2) Run the engine at slow speed and raise and lower the boom 4 – 5 times.
      ★ Stop the piston rod about 100 mm before each stroke end. Never relieve the oil.



9JF01357

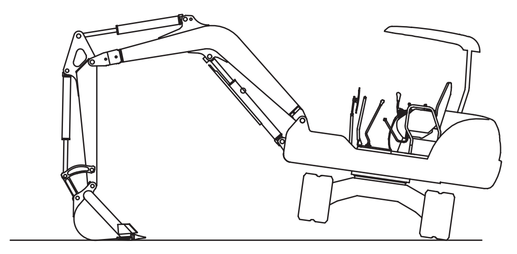
   3) Run the engine at full throttle and perform step 2), then run the engine at low speed and move the piston rod to the stroke end and relieve the oil.
      ★ Bleed air from the arm cylinder, bucket cylinder, boom swing cylinder, and blade cylinder according to steps 2) and 3).

3. **Bleeding air from swing motor**
   1) Run the engine at low idle and swing the upper structure to the left by 3 turns.
   2) Swing the upper structure to the right by 3 turns.



9JF01358

4. **Bleeding air from travel motor**
   1) Run the engine at low idle and float the left track shoe by using the work equipment.
   2) Running the engine at low idle, rotate the left track shoe idle for about 30 seconds.
   3) Performance procedures 1) and 2) for the right track shoe.



9JF01359

5. **Pressurizing hydraulic tank**
   1) Before pressurizing the hydraulic tank, check the hydraulic oil level.
   2) Referring to PRESSURIZING HYDRAULIC TANK, pressurize the hydraulic tank.

RELEASING RESIDUAL PRESSURE FROM HYDRAULIC CIRCUIT

⚠ Since an accumulator is not installed, the residual pressure in the piping between the main control valve and each hydraulic cylinder or swing motor cannot be released even if the control levers are operated.
When removing the above piping, observe the following points.

1. Run the engine at low idle and lower the work equipment to the ground, taking care not to relieve the cylinder at the stroke end, then stop the engine.
   ★ If the hydraulic cylinder is relieved at the stroke end before the engine is stopped, do not perform the following work for 5 – 10 minutes.

2. Loosen the sleeve nut of the piping gradually to release the residual pressure from the piping until oil does not come out any more, then remove the piping.

RELEASING RESIDUAL PRESSURE FROM HYDRAULIC TANK

⚠ The hydraulic tank is enclosed and pressurized.
When remove a hose or a plug connected to the hydraulic tank, release the residual pressure from the hydraulic tank according to the following procedure.

1. Lower the work equipment to the ground and stop the engine.

2. Loosen the oil filler cap of the hydraulic tank gradually to release the pressure from the tank.

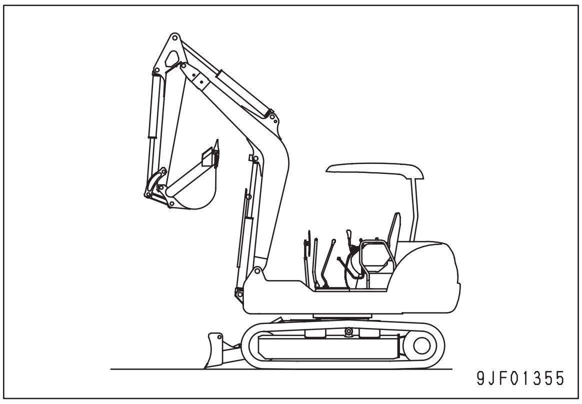
PRESSURIZING HYDRAULIC TANK

★ If the oil filler cap is removed from the hydraulic tank, pressurize the hydraulic tank according to the following procedure.

1. Run the engine at low idle and set the work equipment in the position for pressurizing the hydraulic tank (Extend the rods of the boom, arm, and bucket cylinders to the respective stroke ends).

2. Stop the engine and open the oil filler cap of the hydraulic tank and tighten it again.

3. Start the engine and lower the work equipment to the ground.
   ★ The hydraulic tank is pressurized by the above operation.

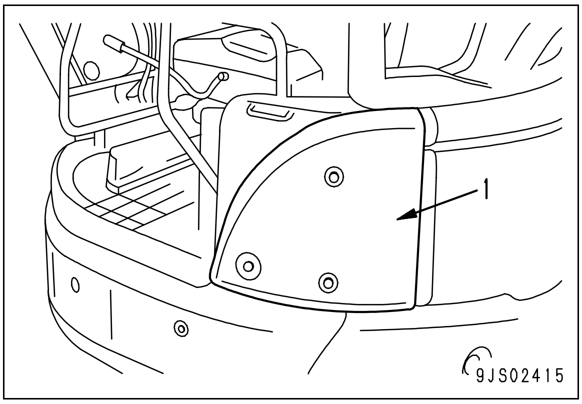


HOW TO OPEN AND CLOSE (TILT) FLOOR

★ When checking or maintaining the back side of the floor or inside of the revolving frame, open and close (tilt) the floor according to the following procedure.

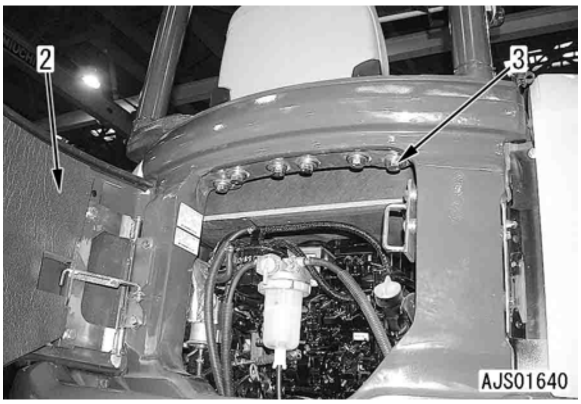
WHEN OPENING (TILTING OPEN)

1. Move in the arm and lower the boom to lower the work equipment and blade to the ground.
2. Stop the engine, and set the work equipment lock lever in the LOCK position.
3. Put blocks in the front and rear of the track shoe to stop the machine.
4. Remove triangular cover (1).



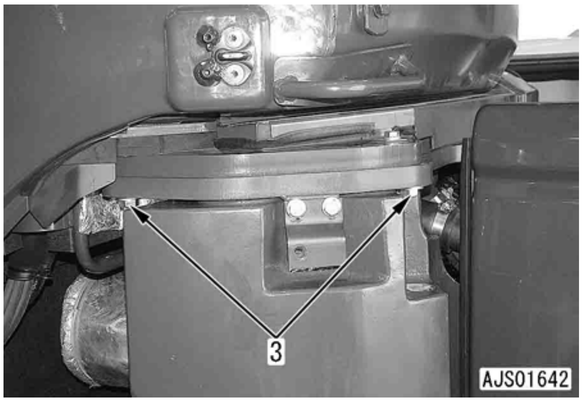
5. Cover and bolts.
   (Except PC35MR-2 with the canopy spec., Serial No. 9242 and up for North America)
   1) Open cover (2) and remove 6 bolts (3).
      ★ The bolts are so designed that they will not be removed completely when they are simply loosened to prevent them from falling.
   2) Close cover (2).

PC27, 30, 35MR-2

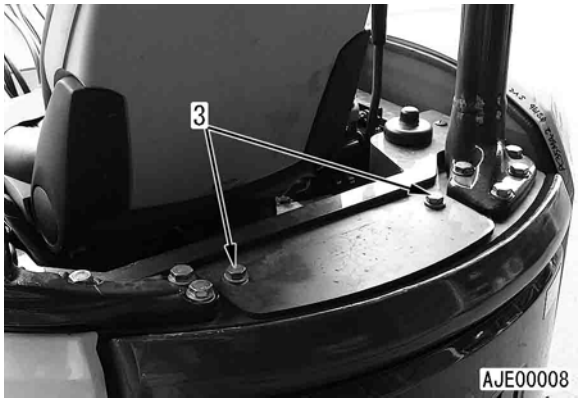


PC40, 50MR-2

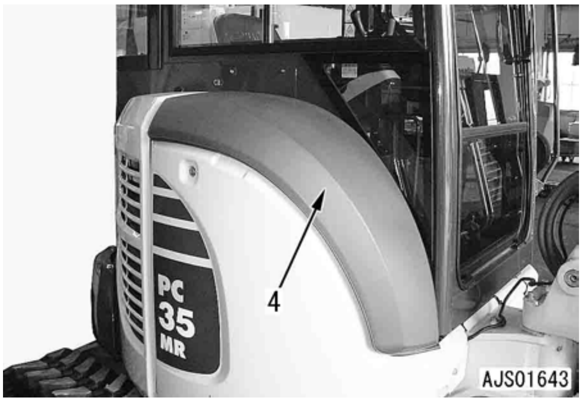
PC40, 50MR-2



6. Remove 2 bolts (3).
   (Only for PC35MR-2 with the canopy spec., Serial No. 9242 and up for North America)

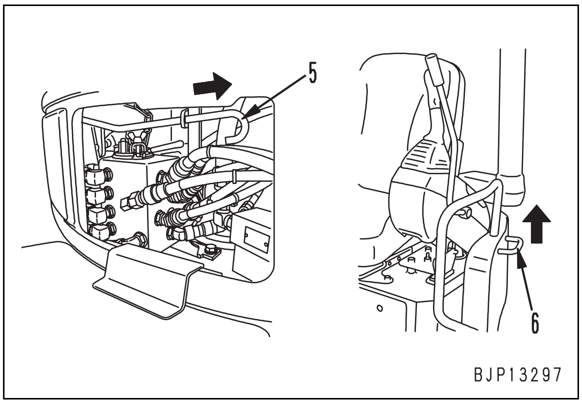


7. Open cover (4).
   ★ Perform this step for only PC27, 30, 35MR-2 with cab specification.

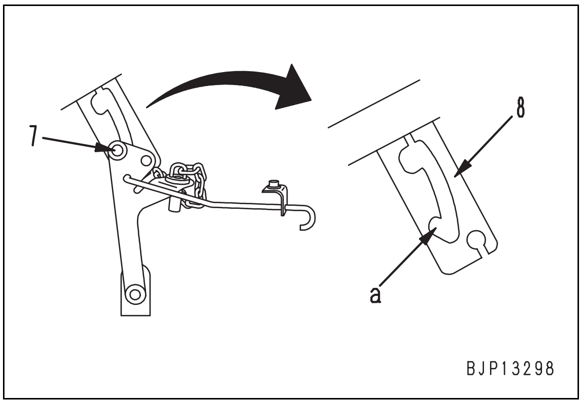


8. Open the inspection cover on the left side of the revolving frame.

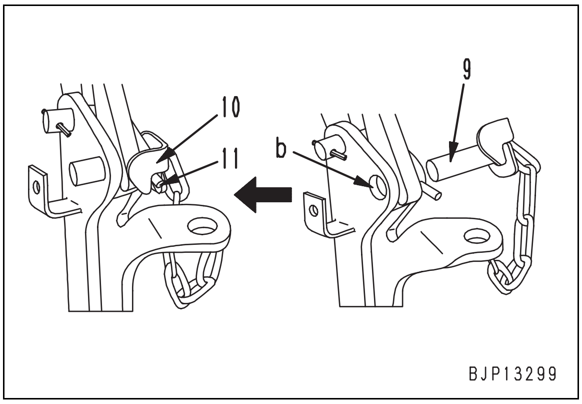
9. While pulling floor lock release lever (5) toward the rear of the machine with the left hand, hold knob (6) with the right hand and push up the floor toward the front of the machine.
   ⚠ Do not put any part of your body under the floor while opening or closing the floor.
   ★ The floor tilts to about 45° toward the front of the machine.
   ★ If the floor does not rise, the release lever may not be in the release position.
   ★ Since the gas spring assists you in opening the floor, the operating effort is increased when the ambient temperature is low.



10. After the floor rises, push up knob (6) until lock pin (7) is fitted to lock groove (a) of lock plate (8).
    ★ When the lock pin moves to the lock groove, the 1st locking is completed.



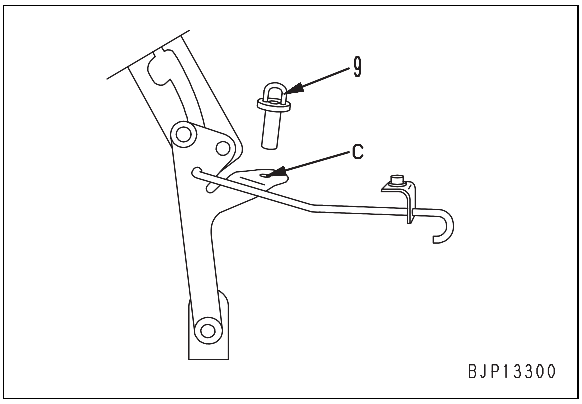
11. Insert 2nd lock pin (9) in lock hole (b) securely and rotate it until lock hook (10) is hitched on fixing pin (11) securely.
    ★ Check that the lock pin is hitched on the fixing pin and it does not come off.
    ★ The 2nd locking is completed and the floor opening (tiling open) work is finished.



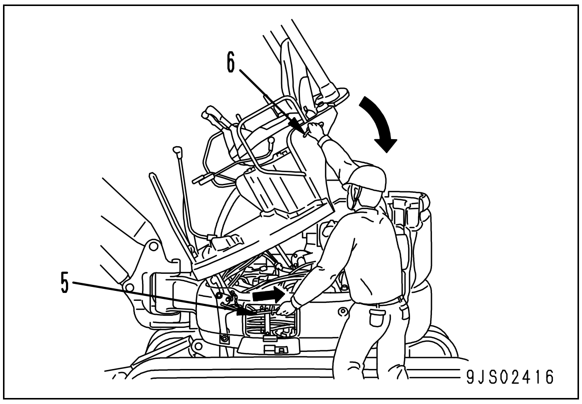
WHEN CLOSING (TILTING CLOSE)

★ Before closing the floor, check that the wiring, piping, and seats on the back side and in the revolving frame are free from damage and abnormality.

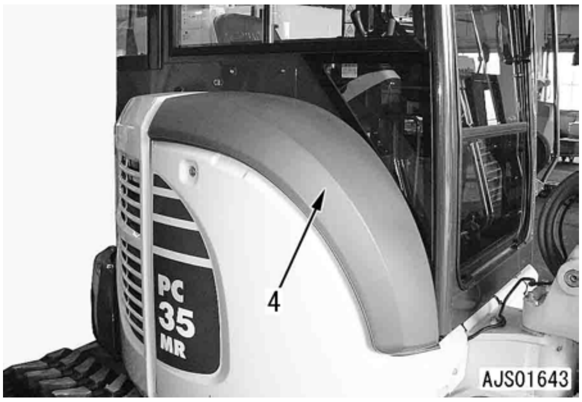
1. Remove lock pin (9) and insert it in storage hole (c).
   ★ If you cannot remove the lock pin, perform the following operation.
   Canopy specification:
   While holding the knob and pushing up the floor, pull out the lock pin.
   Cab specification:
   While holding the knob and pushing down the floor, pull out the lock pin.



2. While pulling floor lock release lever (5) toward the rear of the machine with the left hand, hold knob (6) with the right hand and push down the floor toward the rear of the machine.
   ⚠ Do not put any part of your body under the floor while opening or closing the floor.
   ★ While checking that the wiring and piping are not caught or damaged, push down the floor slowly.



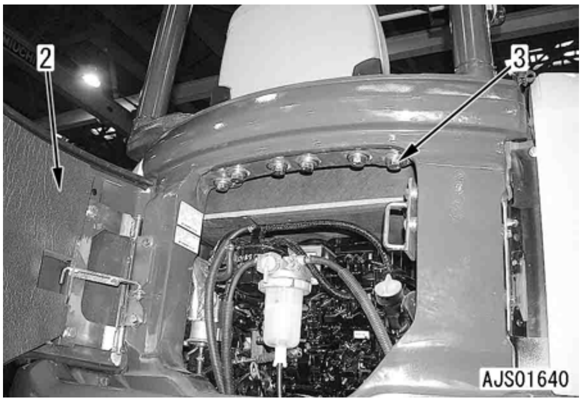
3. Close cover (4).
   ★ Perform this step for only PC27/30/35MR-2 with cab specification.



4. Cover and bolts.
   (Except PC35MR-2 with the canopy spec., Serial No. 9242 and up for North America.)
   1) Open cover (2) and tighten 6 floor fixing bolts (3).
      ★ If a fixing bolt has a flaw, replace it with a new one.

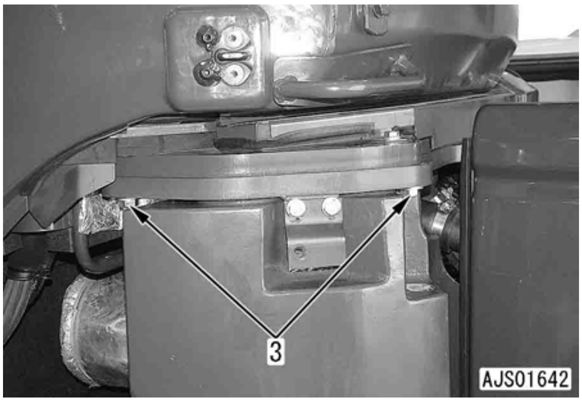
      Fixing bolt:
      156.8 – 196 Nm {16 – 20 kgm}
   2) Colse cover (2).

PC27 • 30 • 35MR-2

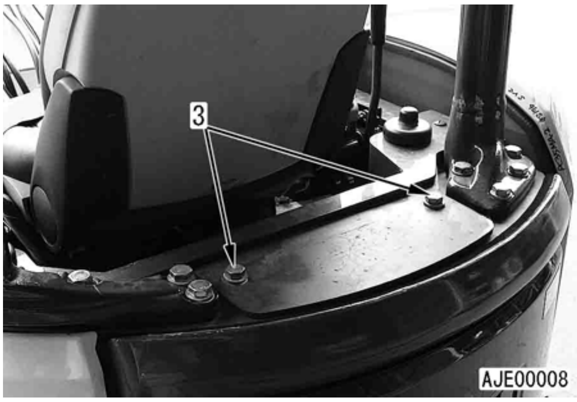


PC40 • 50MR-2

PC40 • 50MR-2

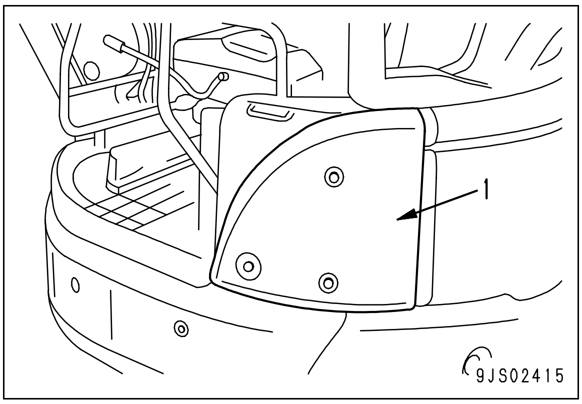


5. Tighten 2 bolts (3).
   (Only for PC35MR-2 with the canopy spec., Serial No. 9242 and up for North America)



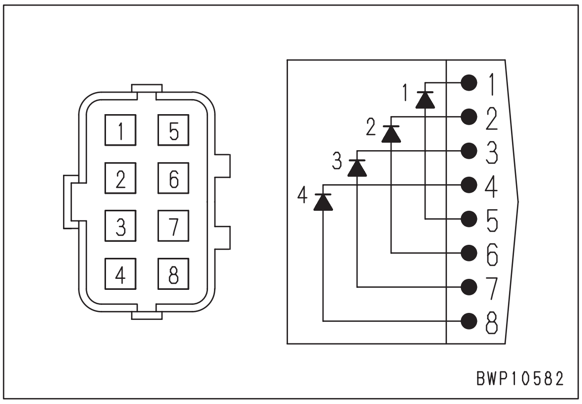
Fixing bolt:
156.8 – 196 Nm {16 – 20 kgm}

6. Install triangular cover (1).
   ★ The floor closing (tilting close) work is finished.

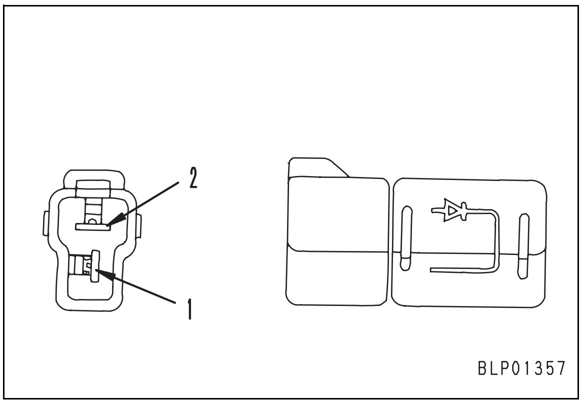


INSPECTION PROCEDURES FOR DIODE

★ Check an assembled-type diode (8 pins) and single diode (2 pins) in the following manner.



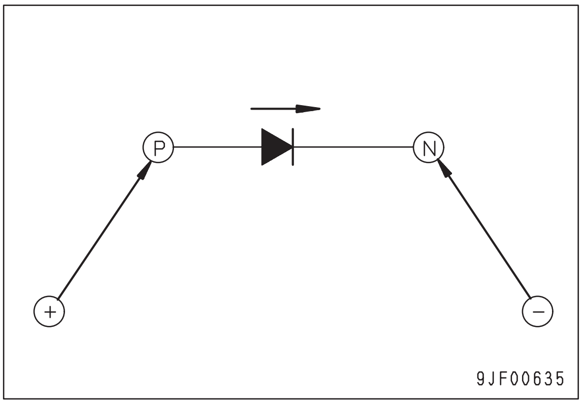
★ The conductive direction of each diode is marked on its surface as shown below.



1. When using digital type circuit tester

1) Switch the testing mode to diode range and confirm the indicated value.
   ★ Voltage of the battery inside is displayed with conventional circuit testers.
2) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode, and confirm the displayed value.
3) Determine if a specific diode is good or no good with the indicated value.
   - No change in the indicated value: No continuity (defective).
   - Change in the indicated value: Continuity established (normal) (Note)

   Note: A silicon diode shows a value between 460 and 600.



2. When using analog type circuit tester

1) Switch the testing mode to resistance range.
2) Check the needle swing in case of the following connections.
   i) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode.
   ii) Put the red probe (+) of the test lead to the cathode (N) and the black probe (–) to the anode (P) of diode.
3) Determine if a specific diode is good or no good by the way the needle swings.
   - If the needle does not swing in Case i), but swings in Case ii): Normal (but the breadth of swing (i.e. resistance value) will differ depending on a circuit tester type or a selected measurement range)
   - If the needle swings in either case of i) and ii): Defective (short-circuited internally)
   - If the needle does not swing in any case of i) and ii): Defective (short-circuited internally)

TROUBLESHOOTING

POINTS TO REMEMBER WHEN TROUBLESHOOTING 20-202
SEQUENCE OF EVENTS IN TROUBLESHOOTING 20-203
POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE 20-204
CHECKS BEFORE TROUBLESHOOTING 20-212
CLASSIFICATION AND PROCEDURES OF TROUBLESHOOTING 20-213
TYPES AND LOCATIONS OF CONNECTORS 20-216
CONNECTOR ARRANGEMENT DIAGRAM 20-222
CONNECTION TABLE FOR CONNECTOR PIN NUMBERS 20-230
T-ADAPTER - BOXES AND T-ADAPTER TABLE 20-252

POINTS TO REMEMBER WHEN TROUBLESHOOTING

⚠ Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.

⚠ When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.

⚠ If the radiator cap is removed when the engine is hot, hot water may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.

⚠ Be extremely careful not to touch any hot parts or to get caught in any rotating parts.

⚠ When disconnecting wiring, always disconnect the negative (–) terminal of the battery first.

⚠ When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure.
When carrying out troubleshooting, and important point is of course to understand the structure and function.
However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
If components are disassembled immediately any failure occurs:
- Parts that have no connection with the failure or other unnecessary parts will be disassembled.
- It will become impossible to find the cause of the failure.

It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator.
For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.

2. Points to ask user or operator
1) Have any other problems occurred apart from the problem that has been reported?
2) Was there anything strange about the machine before the failure occurred?
3) Did the failure occur suddenly, or were there problems with the machine condition before this?
4) Under what conditions did the failure occur?
5) Had any repairs been carried out before the failure?
When were these repairs carried out?
6) Has the same kind of failure occurred before?

3. Check before troubleshooting
1) Check the oil level
2) Check for any external leakage of oil from the piping or hydraulic equipment.
3) Check the travel of the control levers.
4) Check the stroke of the control valve spool.
5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.

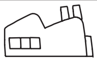
4. Confirming failure
- Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
  ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.

5. Troubleshooting
- Use the results of the investigation and inspection in Items 2 – 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
  ★ The basic procedure for troubleshooting is as follows.
  1) Start from the simple points.
  2) Start from the most likely points.
  3) Investigate other related parts or information.

6. Measures to remove root cause of failure
- Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
  To prevent this, always investigate why the problem occurred. Then, remove the root cause.

SEQUENCE OF EVENTS IN TROUBLESHOOTING

Office, shop

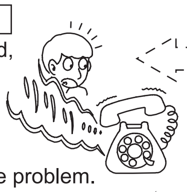


TEW00180

Step 1

Examination, confirmation of symptoms

1) When a request for repairs is received, first ask the following points.
   - Name of customer
   - Type, serial number of machine
   - Details of jobsite, etc.
2) Ask questions to gain an outline of the problem.
   - Condition of failure
   - Work being carried out at the time of the failure
   - Operating environment
   - Past history, details of maintenance, etc.



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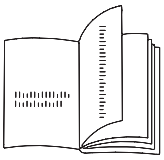
Step 2

Determining probable location of cause

1) Look at the troubleshooting section of the shop manual to find locations of possible causes.



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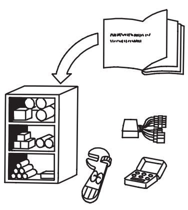
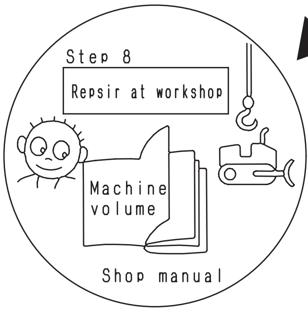
Step 3

Preparation of troubleshooting tools

1) Look at the table of troubleshooting tools in the shop manual and prepare the necessary tools.
   - T-adapter
   - Hydraulic pressure gauge kit, etc.
2) Look in the parts book and prepare the necessary replacement parts.



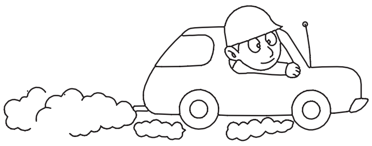
TEW00186



TEP01351

Step 4

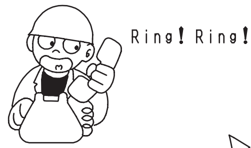
Go to jobsite



TEW00189

Jobsite

TEW00181



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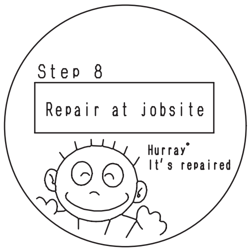
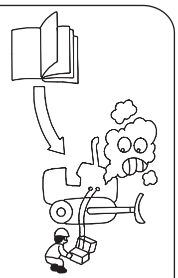


TEP01349

Step 7

- Pinpoint locations of failure (carry out troubleshooting)
- Decide action to take

1) Before starting troubleshooting, locate and repair simple failures.
   - Check before starting items
   - Other check items
2) See the Troubleshooting Section of the shop manual, select a troubleshooting flowchart that matches the symptoms, and carry out troubleshooting.



TEW00187

Step 6

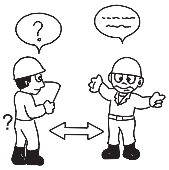
Re-enacting failure

- Drive and operate the machine to confirm the condition and judge if there is really a failure.

Step 5

Ask operator questions to confirm details of failure.

- Was there anything strange about the machine before the failure occurred?
- Did the failure occur suddenly?
- Had any repairs been carried out before the failure?



TEW00190

POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

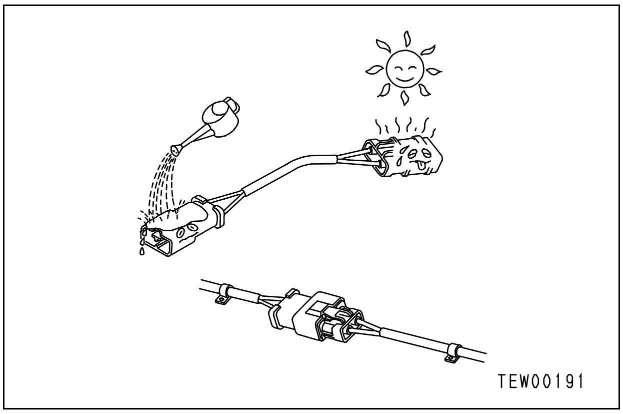
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on "Handling electric equipment" and "Handling hydraulic equipment" (particularly gear oil and hydraulic oil).

1. Points to remember when handling electric equipment

1) Handling wiring harnesses and connectors

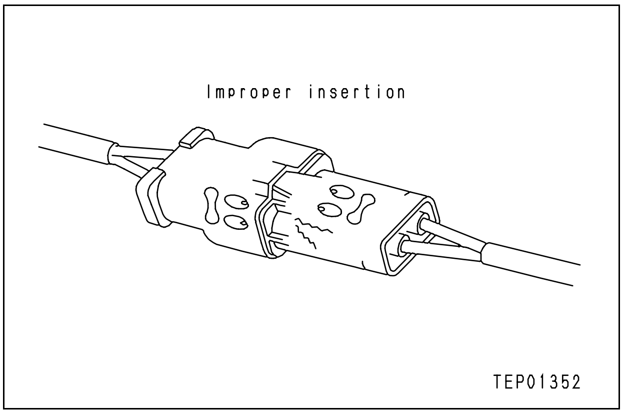
Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.

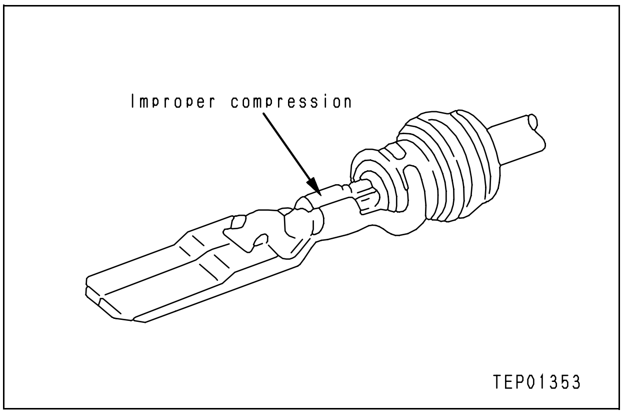


Main failures occurring in wiring harness

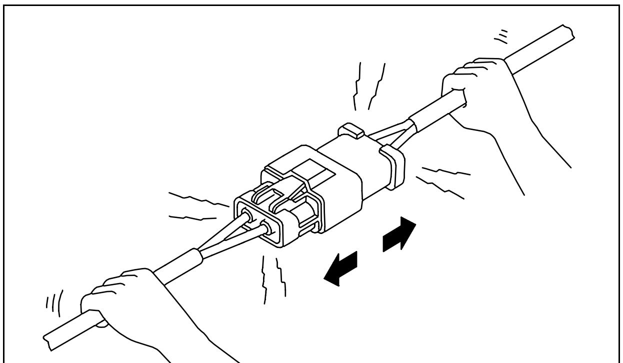
(1) Defective contact of connectors (defective contact between male and female)
Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces.



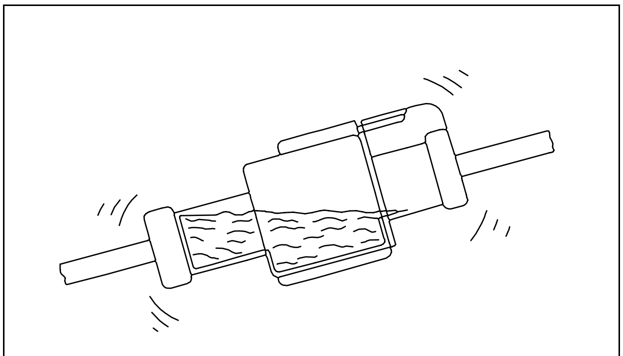
(2) Defective crimping or soldering of connectors
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



(3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.

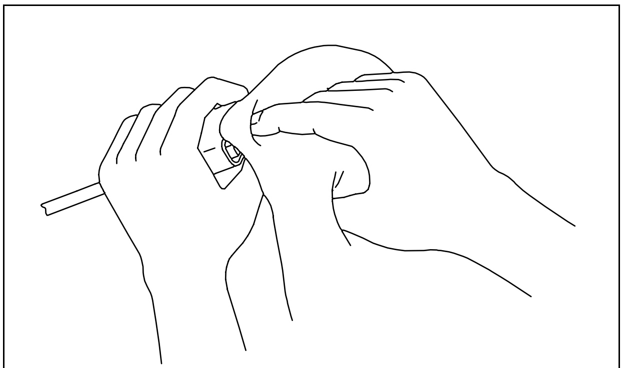

TEW00194

(4) High-pressure water entering connector
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet.
As already said, the connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.


TEW00195

(5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact.
If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.

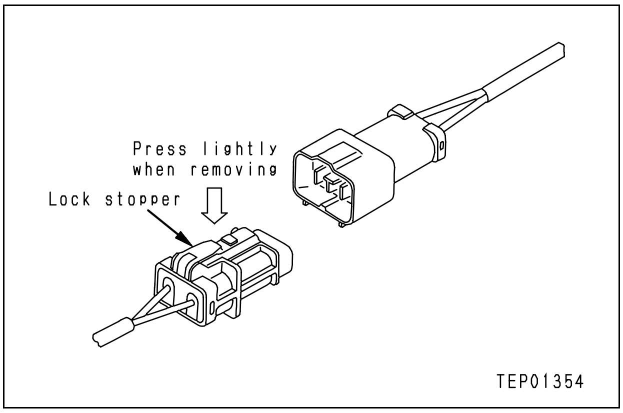
★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.


TEW00196

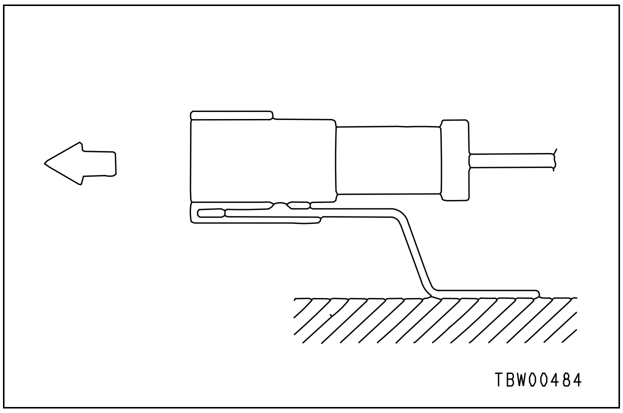
2) Removing, installing, and drying connectors and wiring harnesses

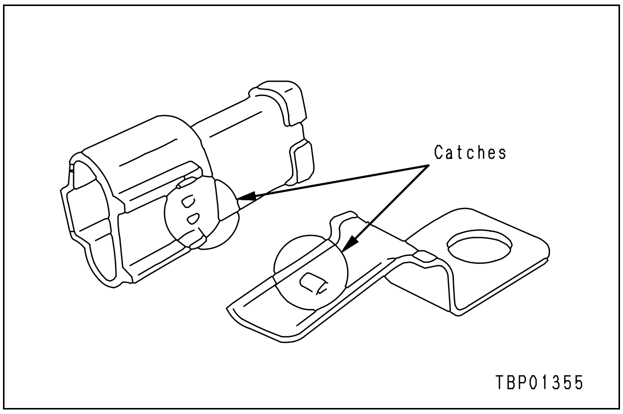
(1) Disconnecting connectors

- Hold the connectors when disconnecting. When disconnecting the connectors, hold the connectors and not the wires. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
  ★ Never pull with one hand.

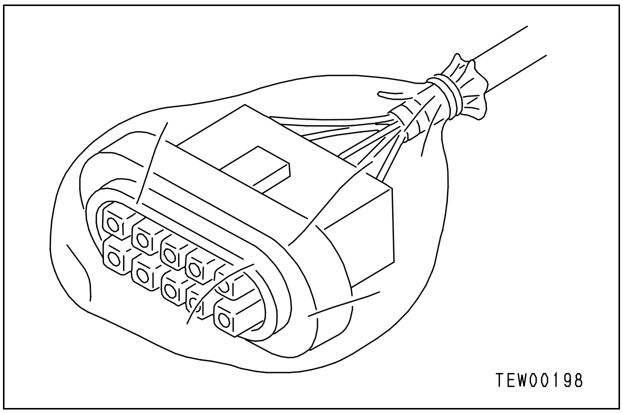


- When removing from clips
  When removing a connector from a clip, pull the connector in a parallel direction to the clip.
  ★ If the connector is twisted up and down or to the left or right, the housing may break.



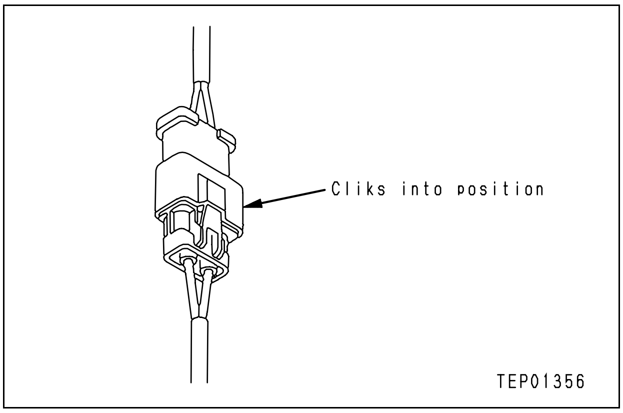


- Action to take after removing connectors
  After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
  ★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.

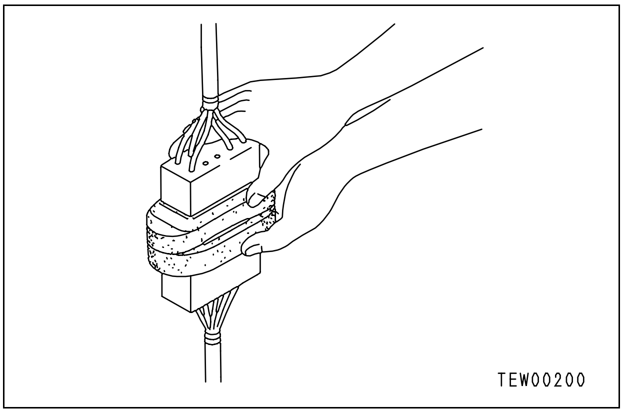


(2) Connecting connectors

- Check the connector visually.
  Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
  Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
  Check that there is no damage or breakage to the outside of the connector.
  ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
  ★ If there is any damage or breakage, replace the connector.

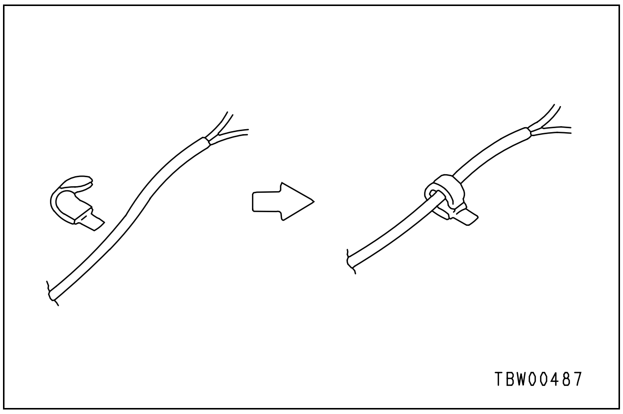


- Fix the connector securely.
  Align the position of the connector correctly, then insert it securely.
  For connectors with lock stopper, push in the connector until the stopper clicks into position.



- Correct any protrusion of the boot and any misalignment of the wiring harness
  For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.
  ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

- If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

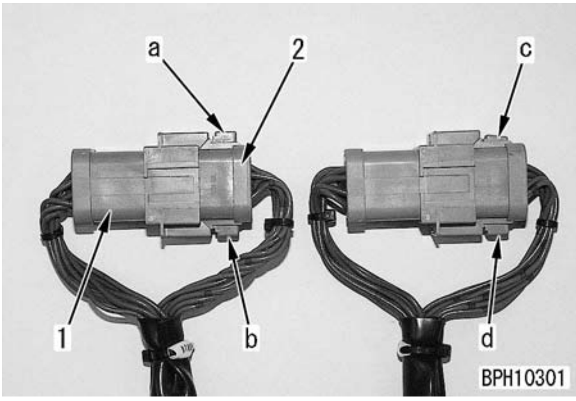


(3) Connecting connectors (DT type connector)

Since the DT 8-pole and 12-pole DT type connectors have 2 latches respectively, push them in until they click 2 times.

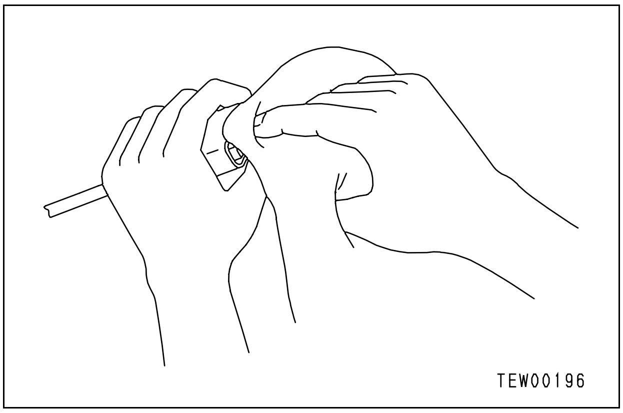
1. Male connector, 2. Female connector

- Normal locking state (Horizontal): **a**, **b**, **d**
- Incomplete locking state (Diagonal): **c**



(4) Drying wiring harness

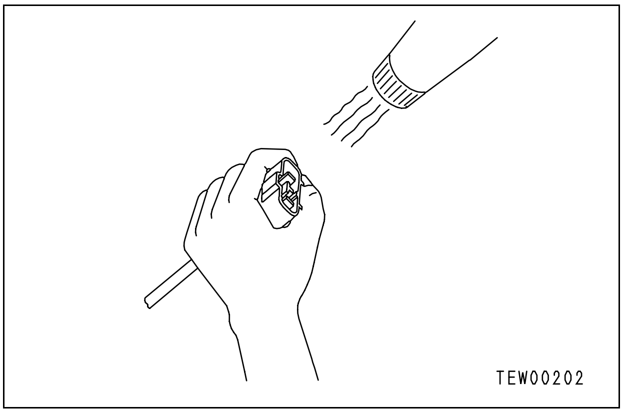
If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.



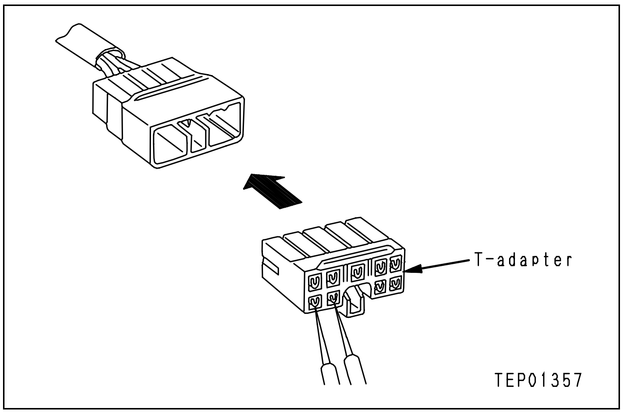
If water gets directly on the connector, do as follows.

- Disconnect the connector and wipe off the water with a dry cloth.
  - ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.

- Dry the inside of the connector with a dryer.
  If water gets inside the connector, use a dryer to dry the connector.
  - ★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

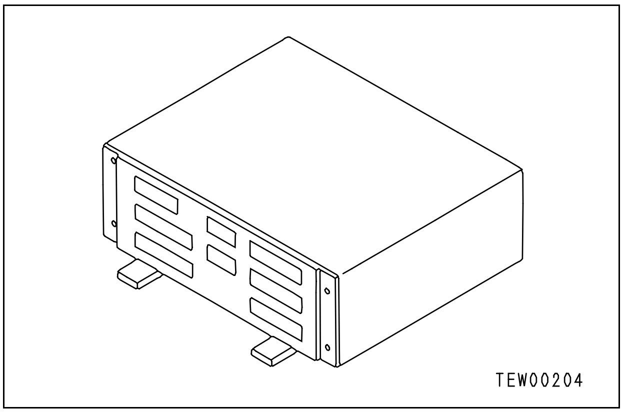


- Carry out a continuity test on the connector.
  After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
  - ★ After completely drying the connector, blow it with contact restorer and reassemble.

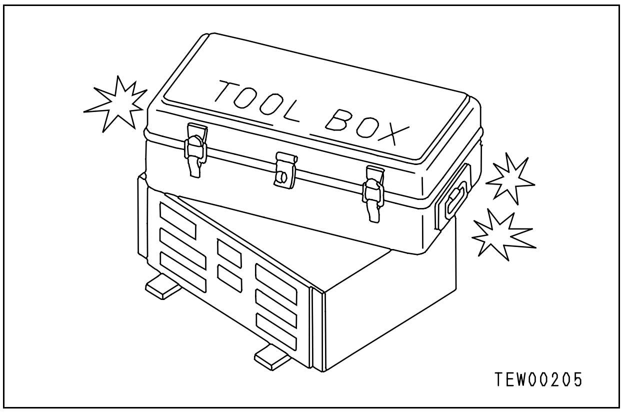


3) Handling control box

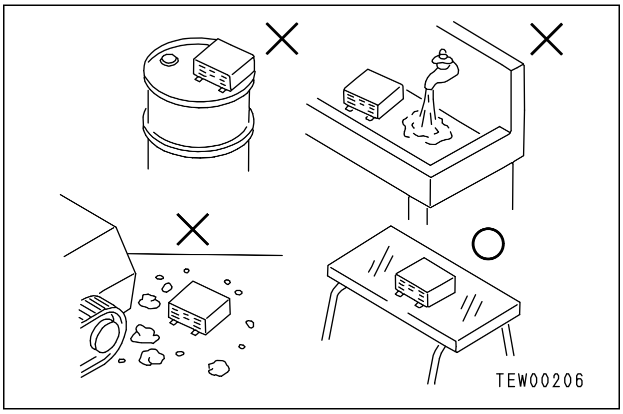
(1) The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.
(2) Do not open the cover of the control box unless necessary.



(3) Do not place objects on top of the control box.
(4) Cover the control connectors with tape or a vinyl bag.
Never touch the connector contacts with your hand.
(5) During rainy weather, do not leave the control box in a place where it is exposed to rain.



(6) Do not place the control box on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
(7) Precautions when carrying out arc welding
When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



2. Points to remember when troubleshooting electric circuits

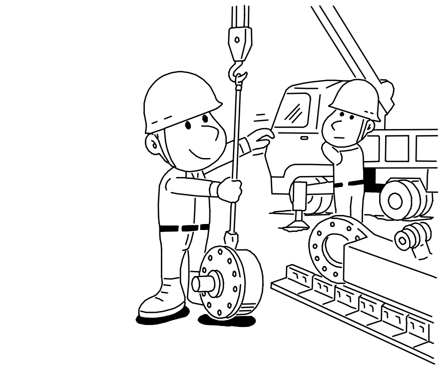
1) Always turn the power OFF before disconnecting or connect connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before going on to the next step.
★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
★ If there is any change, there is probably defective contact in that circuit.

3. Points to remember when handling hydraulic equipment

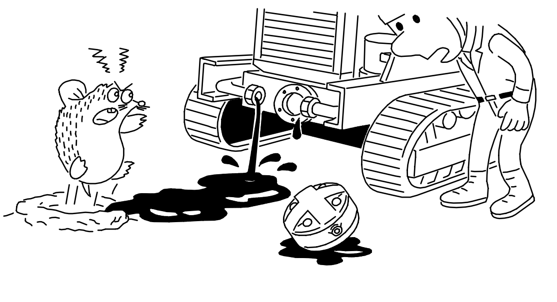
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1) Be careful of the operating environment.
Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

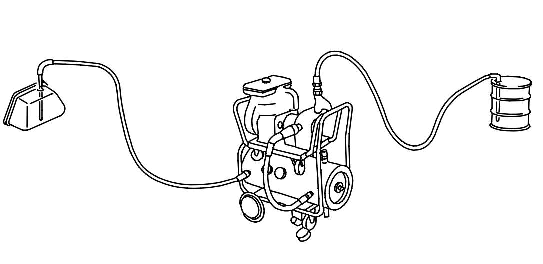
2) Disassembly and maintenance work in the field
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and main-tenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be confirmed with special test equipment.


TEW00207

3) Sealing openings
After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this.
Do not simply drain oil out on to the ground, collect it and ask the customer to dispose of it, or take it back with you for disposal.


TEW00208

4) Do not let any dirt or dust get in during refilling operations.
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.


TEW00209

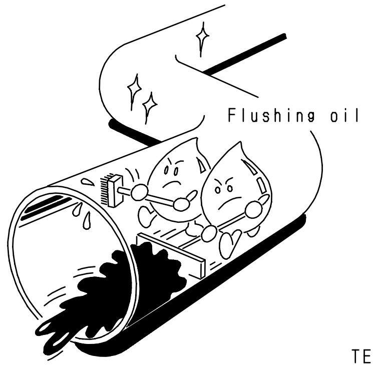
5) Change hydraulic oil when the temperature is high.

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.

Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.

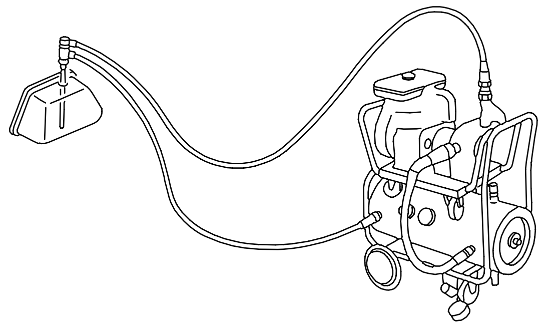


TEP01358

7) Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.

The oil cleaning equipment is used to remove the ultrafine (about 3µ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



TEW00211

CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement value	Action
Lubricating oil, coolant	1. Check fuel level, type of fuel	—	Add fuel
	2. Check for impurities in fuel	—	Clean, drain
	3. Check for clogging of fuel filter cartridge	—	Replace
	4. Check engine oil level in oil pan, type of oil	—	Add oil
	5. Check for clogging of engine oil filter	—	Replace
	6. Check coolant level	—	Add water
	7. Check for clogging of air cleaner	—	Clean or replace
	8. Check hydraulic oil level, type of oil	—	Add oil
	9. Check for clogging of hydraulic oil strainer	—	Clean, drain
	10. Check for clogging of hydraulic oil filter	—	Replace
	11. Check swing machinery oil level, type of oil	—	Add oil
	12. Check final drive oil level, type of oil	—	Add oil
Electrical equipment	1. Check for looseness, corrosion of battery terminal, wiring	—	Tighten or replace
	2. Check for looseness, corrosion of alternator terminal, wiring	—	Tighten or replace
	3. Check for looseness, corrosion of starting motor terminal, wiring	—	Tighten or replace
Hydraulic, mechanical equipment	1. Check for abnormal noise, smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Carry out air bleeding	—	Bleed air
Electrics, electrical equipment	1. Check battery voltage (engine stopped)	10 – 15V	Replace
	2. Check battery electrolyte level	—	Add or replace
	3. Check for discolored, burnt, exposed wiring	—	Replace
	4. Check for missing wiring clamps, hanging wiring	—	Repair
	5. Check for water leaking on wiring (be particularly careful attention to water leaking on connectors or terminals)	—	Disconnect connector and dry
	6. Check for blown, corroded fuses	—	Replace
	7. Check alternator voltage (engine running at 1/2 throttle or above)	After running for several minutes : 13.5 – 14.5V	Replace
	8. Check operating sound of battery relay (when switch is turned ON/OFF)	—	Replace

CLASSIFICATION AND PROCEDURES OF TROUBLESHOOTING

Classification of troubleshooting

Mode	Contents
E-mode	Troubleshooting for electric system
H-mode	Troubleshooting for hydraulic and mechanical system
M-mode	Troubleshooting for monitor panel
S-mode	Troubleshooting for engine unit

Procedure for troubleshooting

If a possible fault is detected in the machine, find a corresponding fault in the table of "Possible faults and troubleshooting Nos.", then go to the indicated troubleshooting section.

Possible faults and troubleshooting Nos.

No.	Possible fault		Troubleshooting			
			E-mode	H-mode	M-mode	S-mode
	Possible faults related to engine					
1	Engine does not start easily (It always takes time to start)					S-1
2	Engine does not start	Engine does not crank	E-1			S-2
3		Engine cranks but exhaust smoke does not come out				S-2
4		Exhaust smoke comes out but engine does not start				S-2
5	Engine speed does not rise sharply (Follow-up performance is low)					S-3
6	Engine stops during operation					S-4
7	Engine rotation is abnormal (Engine hunts)					S-5
8	Output is insufficient or power is low					S-6
9	Exhaust gas color is bad (Incomplete combustion)					S-7
10	Oil is consumed much or exhaust gas color is bad					S-8
11	Oil becomes dirty quickly					S-9
12	Fuel is consumed much					S-10
13	Coolant contains oil , blows back, or reduces					S-11
14	Engine oil pressure caution lamp lights up (Oil pressure lowers)					S-12
15	Oil level rises (Water or fuel is mixed in oil)					S-13
16	Coolant temperature rises too high (Overheating)					S-14
17	Abnormal sound comes out					S-15
18	Vibration is excessive					S-16
19	Engine does not stop		E-2			
20	Engine is not preheated normally				M-6	
	Possible faults related to work equipment, travel, swing, and blade					
21	Speed or power of whole work equipment, travel, swing, and blade is low			H-1		
22	Engine speed lowers extremely or engine stalls			H-2		
23	Work equipment, travel, swing, and blade systems do not work			H-3		

No.	Possible fault	Troubleshooting			
		E-mode	H-mode	M-mode	S-mode
24	Abnormal sound comes out from around hydraulic pump		H-4		
25	Fine control performance or response is low		H-5		
	Possible faults related to work equipment				
26	When work equipment lock lever is set in LOCK position, work equipment still moves	E-3			
27	Speed or power of boom is low		H-6		
28	Speed or power of arm is low		H-7		
29	Speed or power of bucket is low		H-8		
30	Speed or power of boom swing is low		H-9		
31	Work equipment does not move singly		H-10		
32	Hydraulic drift of work equipment is large		H-11		
33	Time lag of work equipment is large		H-12		
34	In compound operation of work equipment, speed of part loaded more is low		H-13		
	Possible faults related to travel				
35	Machine deviates during travel		H-14		
36	Speed or power of travel is low (While work equipment operates normally)		H-15		
37	Machine is not steered well or steering power is low		H-16		
38	Travel speed does not change		H-17		
39	Travel motor does not work		H-18		
	Possible faults related to swing				
40	Speed or power of swing is low		H-19		
41	Machine does not swing		H-20		
42	Swing acceleration is low		H-21		
43	Machine overruns when it stops swinging		H-22		
44	Large shock is made when machine stops swinging		H-23		
45	Large sound is made when machine stops swinging		H-24		
46	Hydraulic drift of swing is large		H-25		
	Possible fault related to blade				
47	Speed or power of blade is low		H-26		
48	Blade does not move		H-27		
49	Hydraulic drift of blade is large		H-28		
	Possible fault related to monitor panel				
50	When starting switch is turned ON, any item does not operate			M-1	
51	When starting switch is turned ON, some items do not operate			M-2	
52	Alarm buzzer is abnormal			M-3	
53	Engine oil pressure caution is turned ON			M-4	
54	Charge level caution is turned ON			M-5	
55	Preheating system does not operate or preheater does not become hot			M-6	
56	Coolant temperature gauge is abnormal			M-7	

No.	Possible fault	Troubleshooting			
		E-mode	H-mode	M-mode	S-mode
57	Fuel level gauge is abnormal			M-8	
58	Service meter does not operate while engine is running			M-9	
59	2nd travel speed is not selected			M-10	
60	Working lamp does not light up			M-11	
	Other possible faults				
61	Windshield wiper does not operate	E-4			
62	Windshield washer does not operate	E-5			
63	Travel alarm does not sound	E-6			
64	Defective air conditioner	E-7			

TYPES AND LOCATIONS OF CONNECTORS

PC27, 30, 35MR-2

(*1): Except PC35MR-2, Serial No. 9242 and up for North America.

Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
D1	SWP	2	Diode	F-5	R-5
F1	X	4	Intermediate connector (Between floor wiring harness and chassis wiring harness)	H-1	U-1
F2	YAZAKI	2	Intermediate connector (Between floor wiring harness and chassis wiring harness)	H-1	T-1
F3	SWP	6	Intermediate connector (Between floor wiring harness and chassis wiring harness)	H-1	U-1
F4	SWP	8	Intermediate connector (Between floor wiring harness and chassis wiring harness)	H-1	T-1
F5	DT-T	2	PPC lock switch (Left)	L-5	X-4
F7	DT-T	4	Windshield wiper (Cab specification)	—	T-1
F8	M	2	Intermediate connector (Cigarette lighter) (Cab specification)	—	X-8
F9	DT-T	2	Optional power supply for canopy	K-9	—
F11	KES1	3	Heater (Cab specification)	—	S-2
F12	KES1	4	Heater switch (Cab specification)	—	X-4
F13	M	2	Horn switch	G-6	S-5
F14	DT-T	2	PPC lock switch (Right) (Canopy specification) (*1)	G-5	—
F15	AMP040	16	Monitor panel	G-7	S-6
F16	KES0	2	Speaker (Right) (Cab specification)	—	X-7
F17	PA	9	Radio (Cab specification)	—	X-6
F18	KES0	2	Speaker (Left) Cab specification)	—	X-6
F19	SUMITOMO	3	Room lamp (Cab specification)	—	U-9
F20	SWP	12	Short connector (Connector for major optional wiring harnesses)	L-4	X-3
F21	DT-T	2	Rotary lamp (If equipped for canopy specification)	K-9	—
F21	M	2	Rotary lamp (If equipped for cab specification)	—	W-9
F22	M	2	Intermediate connector (Additional working lamp)	—	W-9
F22A	DT-T	2	Additional working lamp (If equipped for canopy specification)	—	—
F22B	DT-T	2	Additional working lamp (If equipped for canopy specification)	—	—
F23	M	3	Intermediate connector (Radio)	—	X-8
F24	M	3	Intermediate connector (Windshield wiper)	—	X-9
F25	Terminal	1	Cigarette lighter (Cab specification)	—	X-7
	Terminal	1	Cigarette lighter (Cab specification)	—	X-7
F28	M	2	Alarm buzzer	G-6	S-5
FB	–	–	Fuse box	L-3	X-3
M1	YAZAKI	2	Horn	D-1	P-1

Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
M2	X	2	Fuel level sensor	A-8	M-8
M3	YAZAKI	4	Timer (For stop solenoid)	B-8	N-8
M4	M	2	Fusible link	C-9	O-9
M5	X	4	Intermediate connector (Optional connector)	—	P-1
M6	KES0	2	Windshield washer motor (Cab specification)	—	O-9
M7	SUMITOMO	3	Alternator	D-9	P-9
M8	DT-T	2	Engine coolant temperature sensor	E-9	Q-9
M9	X	3	Engine stop solenoid	F-9	R-9
M10	X	2	Fuel pump	F-6	R-6
M11	DT-T	2	Intermediate connector (Travel alarm)	F-2	R-2
M12	DT-T	2	PPC lock solenoid	E-1	Q-1
M13	DT-T	2	2nd travel speed selection solenoid	E-1	Q-1
M14	SWP	1	Air conditioner compressor (Cab specification)	—	Q-9
R1	Relay	5	Starting motor circuit relay	L-1	X-1
R2	Relay	5	PPC lock solenoid relay	L-2	X-2
R3	Relay	5	Working lamp relay	K-1	X-1
R4	Relay	5	2nd travel speed selection solenoid relay	K-1	X-1
R5	Relay	5	Additional working lamp relay (Cab specification)	—	W-1
R6	R	5	—	—	—
RM1	YAZAKI	2	Stop solenoid relay	B-8	N-8
RM2	YAZAKI	1	Stop solenoid relay	B-8	N-8
RM3	YAZAKI	1	Stop solenoid relay	B-8	N-8
RM4	SUMITOMO	6	Safety relay	B-9	N-9
RM5	SUMITOMO	2	Safety relay	B-9	N-9
T1	DT-T	2	Travel alarm (If equipped)	F-2	R-2
T2	X	2	Travel pressure switch (If equipped)	F-2	R-2
T3	X	2	Travel pressure switch (If equipped) * Only PC27, 30MR-2	F-2	R-2
T4	X	2	Travel pressure switch (If equipped) * Only PC27, 30MR-2	E-2	Q-2
T5	X	2	Travel pressure switch (If equipped) * Only PC27, 30MR-2	E-2	Q-2
T-F1	Terminal	1	Starting switch terminal B	G-9	S-9
T-F2	Terminal	1	Starting switch terminal BR	G-8	S-8
T-F3	Terminal	1	Starting switch terminal ACC	G-8	S-9
T-F4	Terminal	1	Starting switch terminal C	G-9	S-9
T-F5	Terminal	1	Starting switch terminal R1	H-9	T-9

Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
T-F6	Terminal	1	Starting switch terminal R2	H-8	T-8
T-M1	Terminal	1	Battery (+)	D-9	P-9
T-M2	Terminal	1	Alternator (B)	D-9	P-9
T-M3	Terminal	1	Engine oil pressure switch	E-9	R-9
T-M4	Terminal	1	Intake air heater	F-9	R-9
T-M5	Terminal	1	Starting motor (Terminal B)	E-9	Q-9
T-M6	Terminal	1	Starting motor (Terminal S)	E-9	Q-9
T-M7	Terminal	1	Revolving frame ground	F-5	R-5
V1	DT	12	—	—	—
V2	X	1	Inspection mode connector (Female)	—	—
V3	X	1	Inspection mode connector (Male)	—	—
W1	DT-T	2	Intermediate connector (Working lamp)	A-8	M-8
W1A	DT-T	2	Intermediate connector (Additional working lamp for canopy specification)	—	—
W1B	DT-T	2	Intermediate connector (Additional working lamp for canopy specification)	—	—
W2	DT-T	3	Working lamp (Installed to boom)	A-6	M-6
W6	DT-T	3	Additional working lamp (If equipped for canopy specification)	—	—

Type of connector	Detailed information
AMP040	040-type connector manufactured by NIHON AMP
DT or DT-T	DT-type connector manufactured by NIHON DEUTSCH (08192-XXXXX)
KES0	KES0-type connector (08027-0XXXX)
KES1	KES1-type connector (08027-1XXXX)
M	M-type connector manufactured by YAZAKI (08056-0XXXX)
R	PH166-05020-type connector manufactured by SHINAGAWA JIDOSHA DENSEN
X	X-type connector manufactured by YAZAKI (08055-0XXXX)
PA	PA-type connector manufactured by YAZAKI
SWP	SWP-type connector manufactured by YAZAKI (08055-1XXXX)
SUMITOMO	Connector manufactured by SUMITOMO
YAZAKI	Connector manufactured by YAZAKI
Terminal	Round terminal or ordinary terminal

PC40, 50MR-2

Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
A2	X	2	Travel pressure switch	AD-3	—
D1	SWP	2	Diode	AD-8	AP-8
F1	X	4	Intermediate connector (Between floor wiring harness and chassis wiring harness)	AE-2	AR-1
F2	YAZAKI	2	Intermediate connector (Between floor wiring harness and chassis wiring harness)	AF-1	AR-1
F3	SWP	6	Intermediate connector (Between floor wiring harness and chassis wiring harness)	AE-2	AR-1
F4	SWP	8	Intermediate connector (Between floor wiring harness and chassis wiring harness)	AE-2	AR-2
F5	DT-T	2	PPC lock switch (Left)	AJ-5	AV-4
F7	DT-T	4	Windshield wiper (Cab specification)	—	AQ-3
F8	M	2	Intermediate connector (Cigarette lighter) (Cab specification)	—	AV-8
F9	DT-T	2	Optional power supply for canopy	AI-9	—
F11	KES1	3	Heater (Cab specification)	—	AQ-3
F12	KES1	4	Heater switch (Cab specification)	—	AV-4
F13	M	2	Horn switch	AE-6	AQ-5
F14	DT-T	2	PPC lock switch (Right) (Canopy specification)	AE-5	—
F15	AMP040	16	Monitor panel	AE-7	AQ-6
F16	KES0	2	Speaker (Right) (Cab specification)	—	AV-7
F17	PA	9	Radio (Cab specification)	—	AV-6
F18	KES0	2	Speaker (Left) (Cab specification)	—	AV-6
F19	SUMITOMO	3	Room lamp (Cab specification)	—	AS-9
F20	SWP	12	Short connector (Connector for major optional wiring harnesses)	AJ-4	AV-3
F21	DT-T	2	Rotary lamp (If equipped for canopy specification)	AI-9	—
F21	M	2	Rotary lamp (If equipped for cab specification)	—	AU-9
F22	M	2	Intermediate connector (Additional working lamp)	—	AU-9
F22A	DT-T	2	Additional working lamp (If equipped for canopy specification)	—	—
F22B	DT-T	2	Additional working lamp (If equipped for canopy specification)	—	—
F23	M	3	Intermediate connector (Radio)	—	AV-7
F24	M	3	Intermediate connector (Windshield wiper)	—	AV-9
F25	Terminal	1	Cigarette lighter (Cab specification)	—	X-7
	Terminal	1	Cigarette lighter (Cab specification)	—	X-7
F26	KES1	4	Heater switch (Canopy specification)	—	—
F27	KES2	3	Heater (Canopy specification)	—	—
F28	M	2	Alarm buzzer	AE-6	AQ-4

Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
FB1	–	–	Fuse box	AJ-3	AV-3
M1	YAZAKI	2	Horn	AB-2	—
M2	KES0	2	Windshield washer motor (Cab specifition)	Z-7	AL-7
M3	SWP	6	Intermediate connector (Optional connector)	AD-5	AP-5
M4	X	4	Intermediate connector (Air conditioner specification)	Y-5	AK-5, AK-9
M5	—	2	Fusible link	Y-7	AK-7
M6	X	2	Fuel lever sensor	Z-7	AL-7
M8	DT-T	2	Travel alarm	Y-5, Y-9	AK-5, AK-8
M9	DT-T	2	Engine coolant temperature sensor	AC-9	AO-9
M10	SUMITOMO	3	Alternator	AA-8	AM-8
M11	DT-T	2	TVC solenoid	AD-6	AP-6
M12	SWP	1	Air conditioner compressor (Cab specification)	AD-9	AP-9
M13	X	3	Engine stop solenoid	AD-7	AP-7
M14	X	2	Fuel pump	AD-6	AP-6
M15	SUMITOMO	6	Safety relay	AC-1	AO-1
M16	SUMITOMO	2	Safety relay	AC-1	AO-1
M17	DT-T	2	2nd travel speed selection solenoid relay	AD-3	AP-3
M18	DT-T	2	PPC lock solenoid	AD-4	AP-4
M19	YAZAKI	2	Engine stop solenoid relay	AD-1	AP-1
M20	YAZAKI	1	Engine stop solenoid relay	AD-1	AP-1
M21	YAZAKI	1	Engine stop solenoid relay	AD-1	AP-1
M22	KES1	4	Timer (For stop solenoid)	AC-1	AO-1
R1	Relay	5	Starting motor circuit relay	AJ-1	AV-1
R2	Relay	5	PPC lock solenoid relay	AJ-2	AV-2
R3	Relay	5	Working lamp relay	AI-1	AV1
R4	Relay	5	2nd travel speed selection solenoid relay	AI-1	AV-1
R5	Relay	5	Additional working lamp relay (Cab specification)	—	W-1
R6	R	5	—	—	—
R7	Relay	5	Air conditioner relay (Air conditionor specification)	—	—
S1	DT-T	2	Register 100Ω (Air conditioner specification)	—	—
S2	DT-T	2	Register 270Ω (Air conditioner specification)	—	—
T-F1	Terminal	1	Starting switch terminal B	AE-9	AQ-9
T-F2	Terminal	1	Starting switch terminal BR	AE-8	AQ-8
T-F3	Terminal	1	Starting switch terminal ACC	AE-8	AQ-8

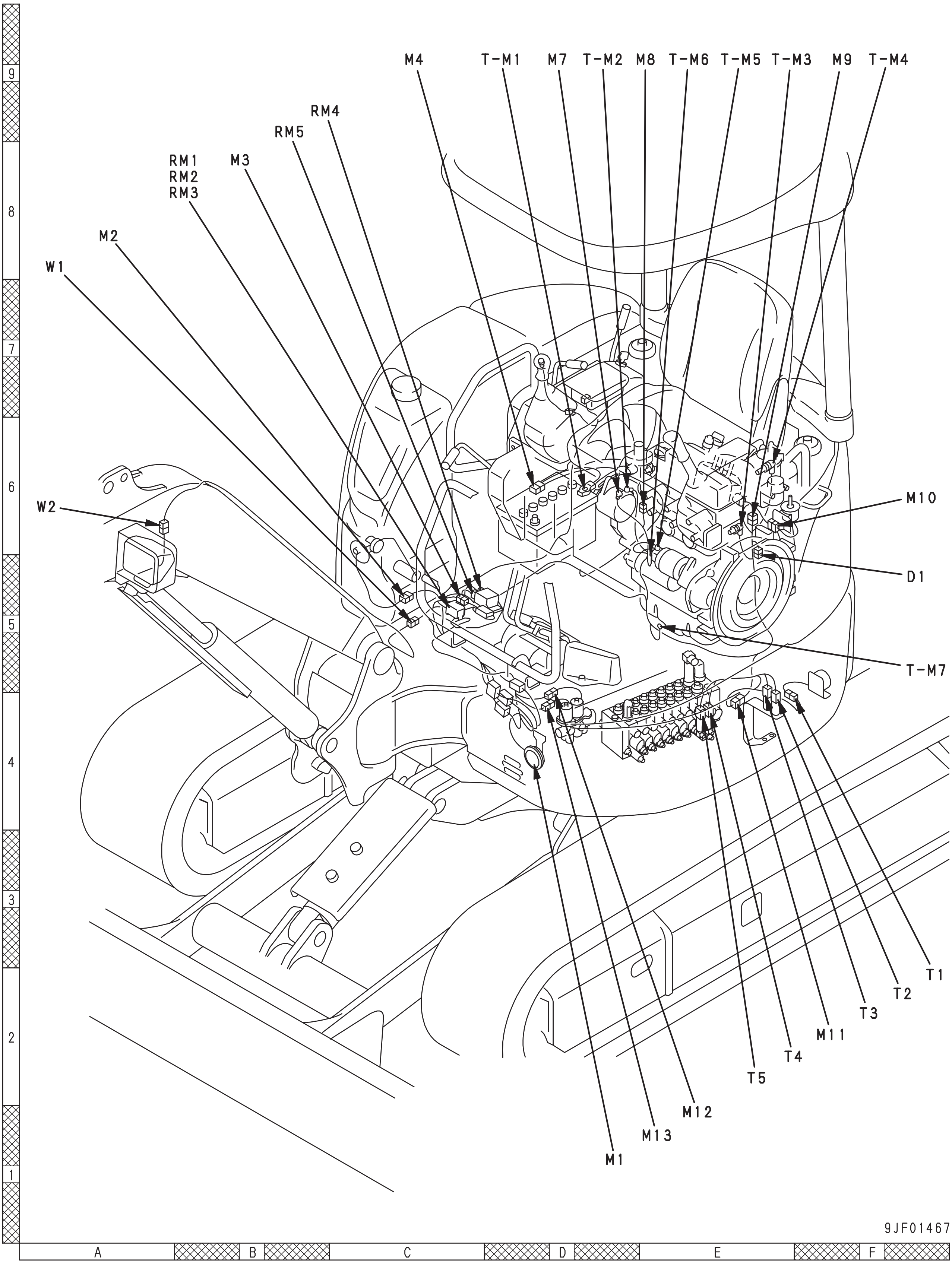
Connector No.	Type	Number of pins	Location	Address of connector arrangement drawing	
				Canopy specification	Cab specification
T-F4	Terminal	1	Starting switch terminal C	AE-9	AQ-9
T-F5	Terminal	1	Starting switch terminal R1	AF-9	AR-9
T-F6	Terminal	1	Starting switch terminal R2	AF-8	AR-8
T-M1	Terminal	1	Battery (+)	Y-6	AK-6
T-M2	Terminal	1	Alternator (B)	AB-9	AN-9
T-M3	Terminal	1	Engine oil pressure switch	AD-6	AP-6
T-M4	Terminal	1	Intake air heater	AD-7	AP-7
T-M5	Terminal	1	Starting motor (Terminal B)	AD-5	AP-5
T-M6	Terminal	1	Starting motor (Terminal S)	AB-9	AN-9
T-M7	Terminal	1	Revolving frame ground	Z-8	AL-8
V1	DT	12	—	—	—
V2	X	1	Inspection mode connector (Female)	—	—
V3	X	1	Inspection mode connector (Male)	—	—
W1	DT-T	2	Intermediate connector (Working lamp)	Y-7	AK-7
W2	DT-T	3	Working lamp (Installed to boom)	Y-6	AK-6

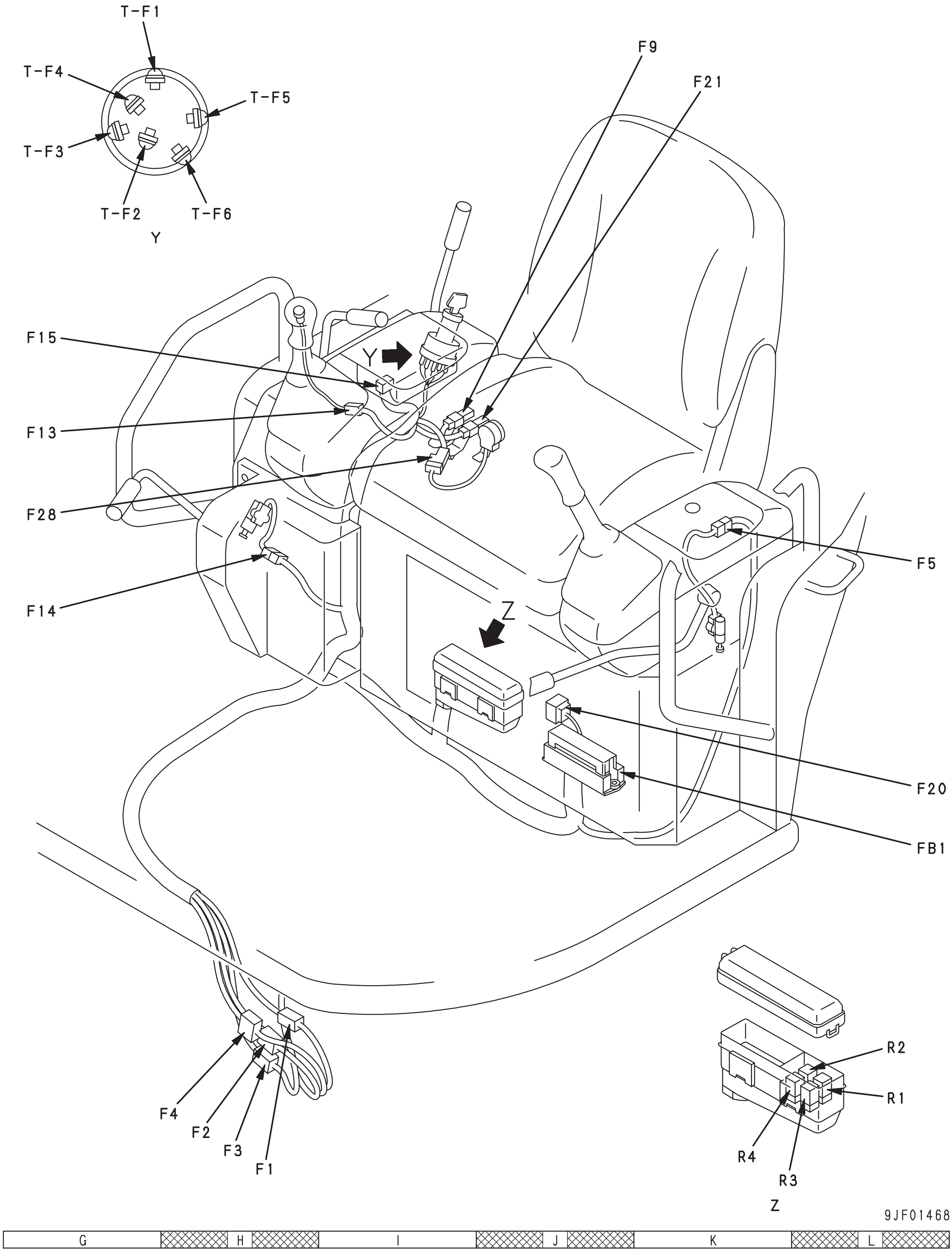
Type of connector	Detailed information
AMP040	040-type connector manufactured by NIHON AMP
DT or DT-T	DT-type connector manufactured by NIHON DEUTSCH (08192-XXXXX)
KES0	KES0-type connector (08027-0XXXX)
KES1	KES1-type connector (08027-1XXXX)
M	M-type connector manufactured by YAZAKI (08056-0XXXX)
R	PH166-05020-type connector manufactured by SHINAGAWA JIDOSHA DENSEN
X	X-type connector manufactured by YAZAKI (08055-0XXXX)
PA	PA-type connector manufactured by YAZAKI
SWP	SWP-type connector manufactured by YAZAKI (08055-1XXXX)
SUMITOMO	Connector manufactured by SUMITOMO
YAZAKI	Connector manufactured by YAZAKI
Terminal	Round terminal or ordinary terminal

CONNECTOR ARRANGEMENT DIAGRAM

PC27, 30, 35MR-2

Canopy specification

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R2
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F4
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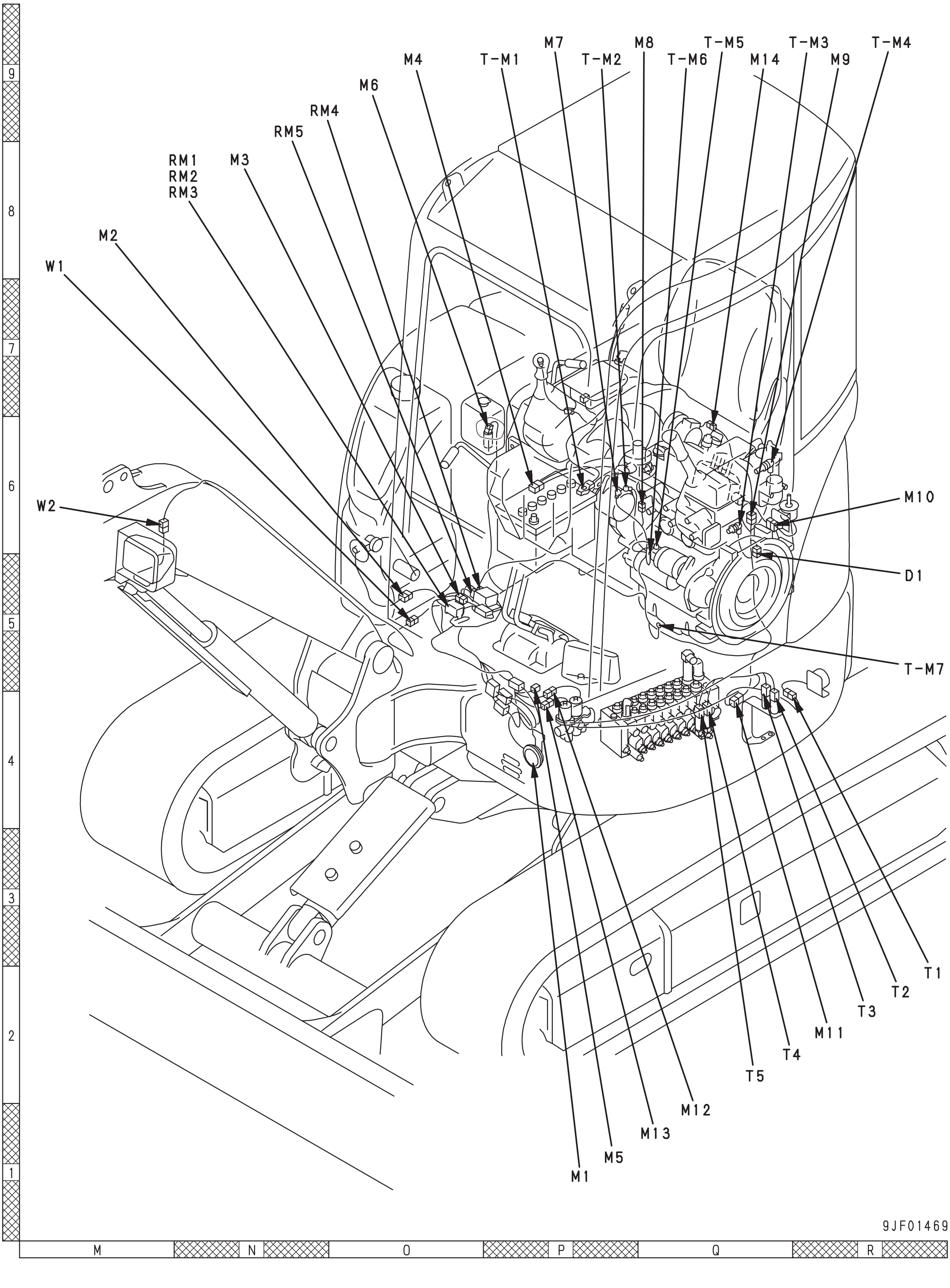
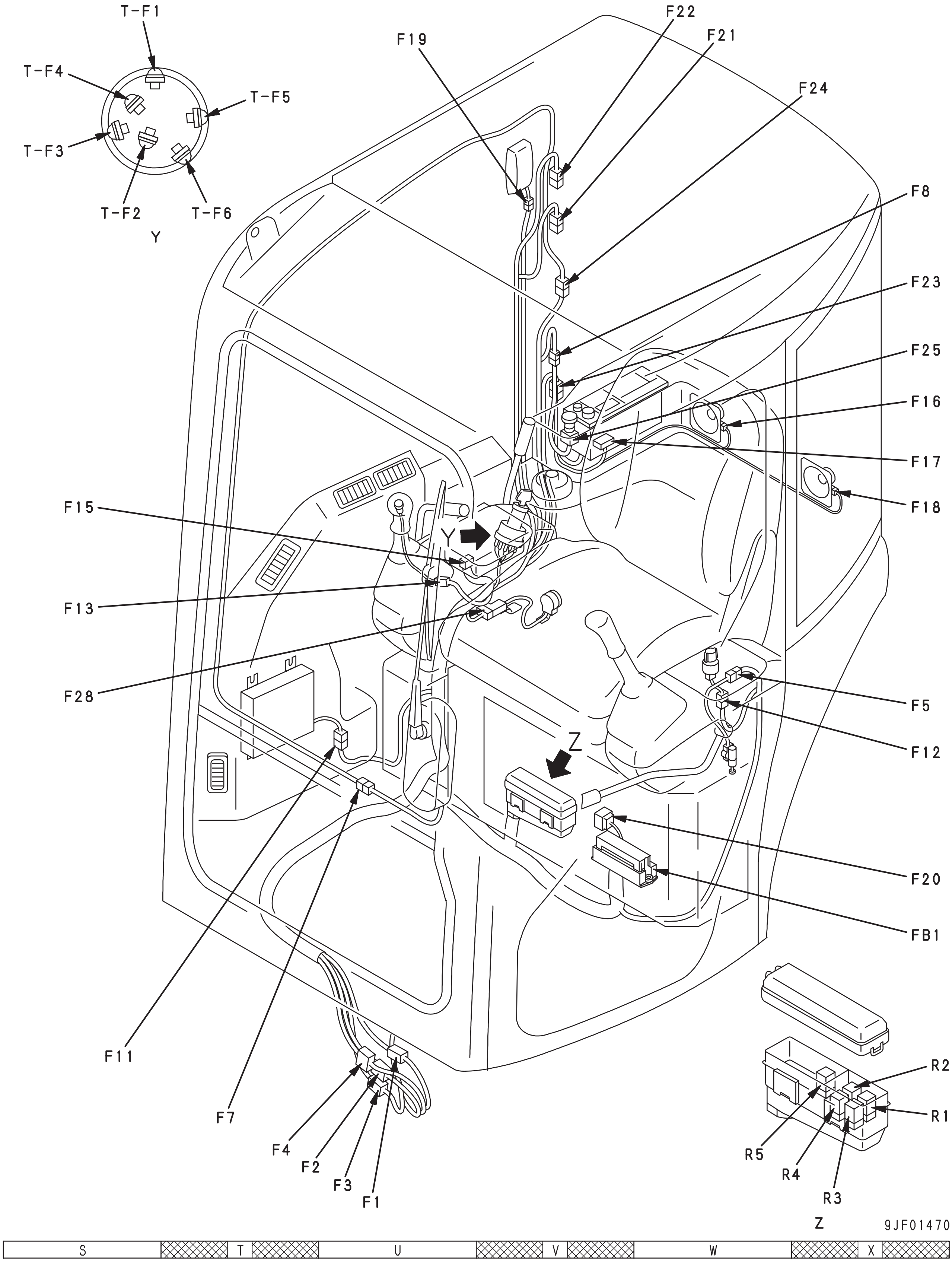
PC27, 30, 35MR-2
Cab specification

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F25
F16
F17
F18
F15
Y
F13
F28
F5
F12
Z
F20
FB1
F11
F7
F4
F2
F3
F1
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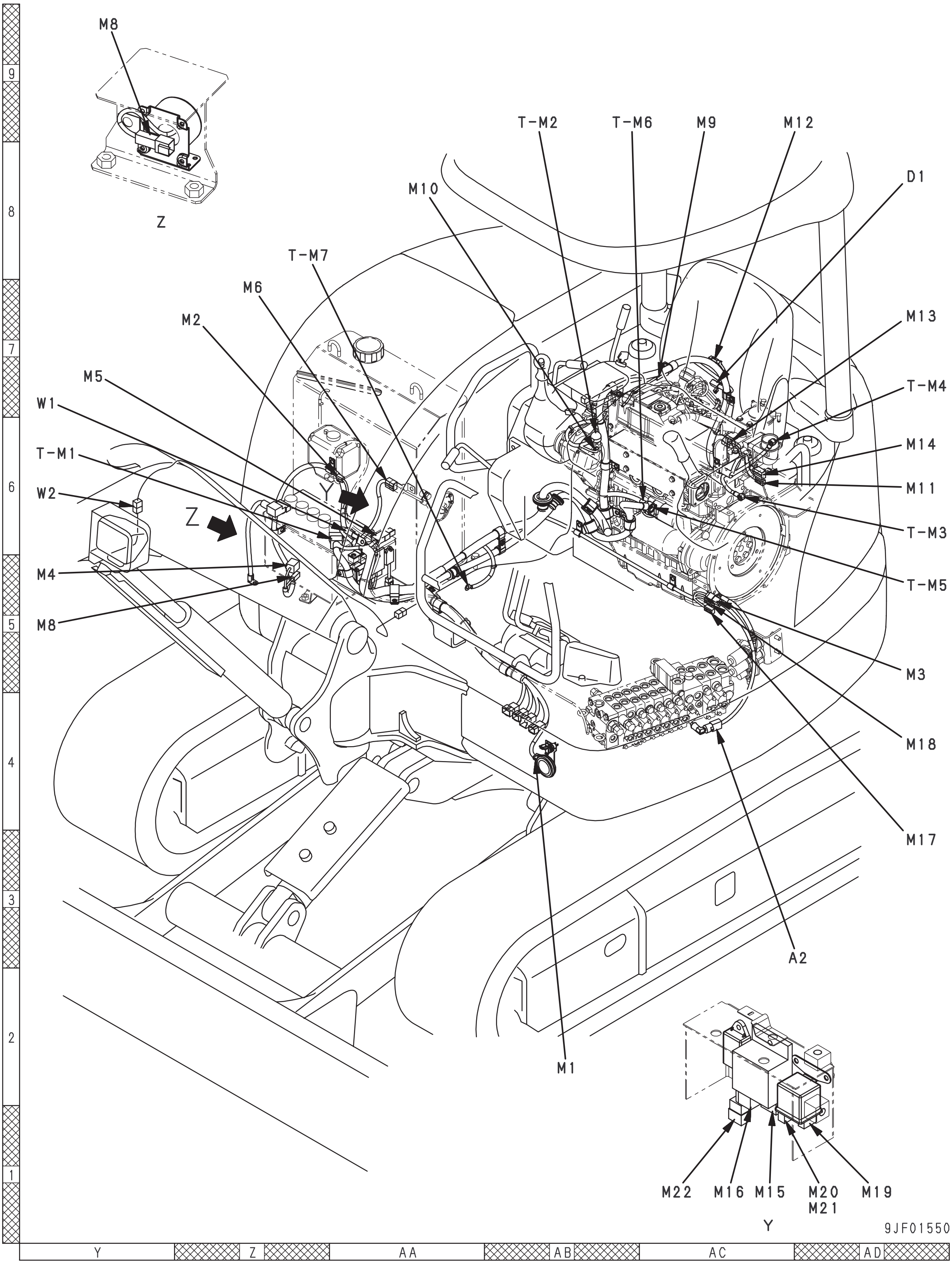
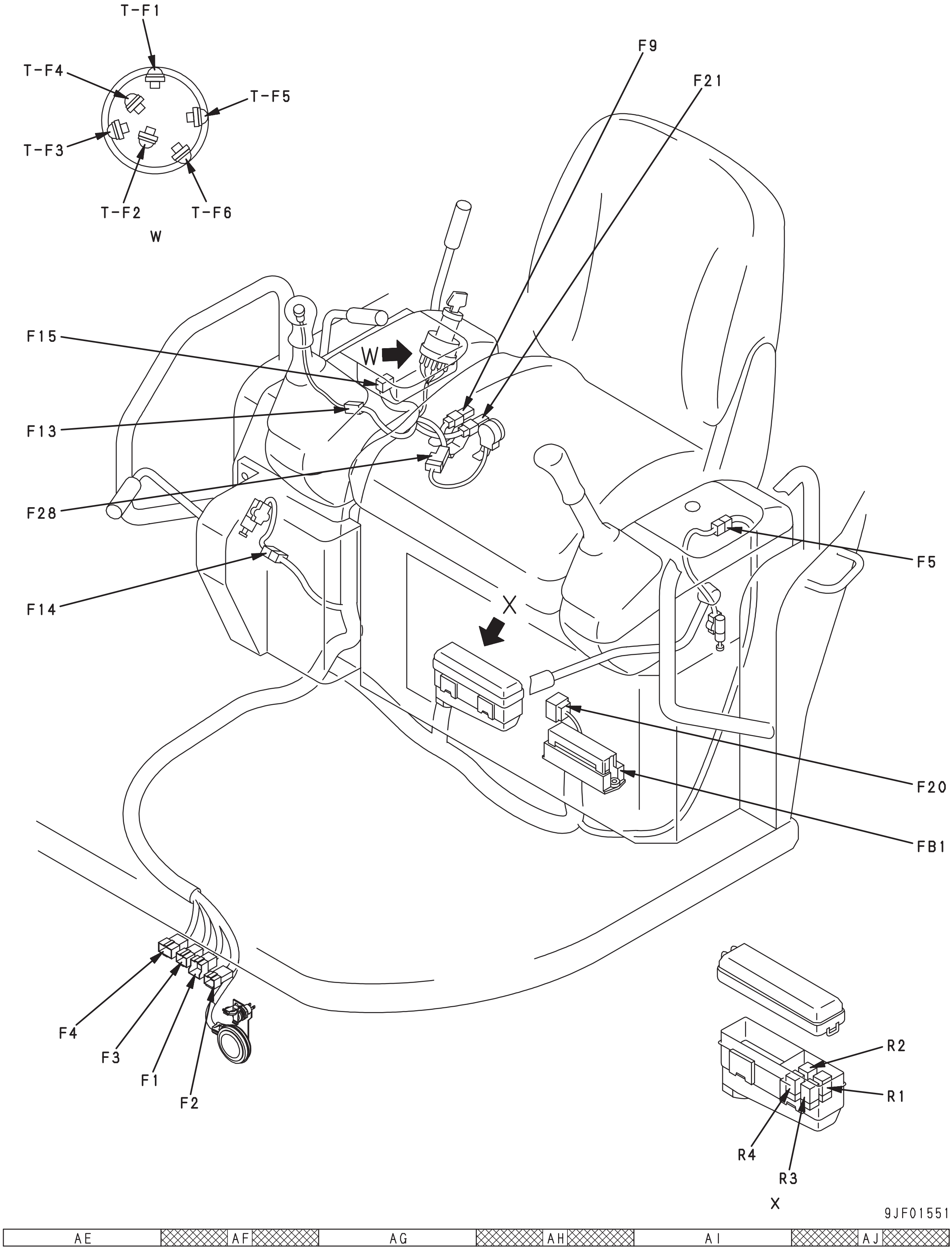
PC40, 50MR-2
Canopy specification

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T-F2
T-F6
W
F9
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F15
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F13
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F20
FB1
F4
F3
F1
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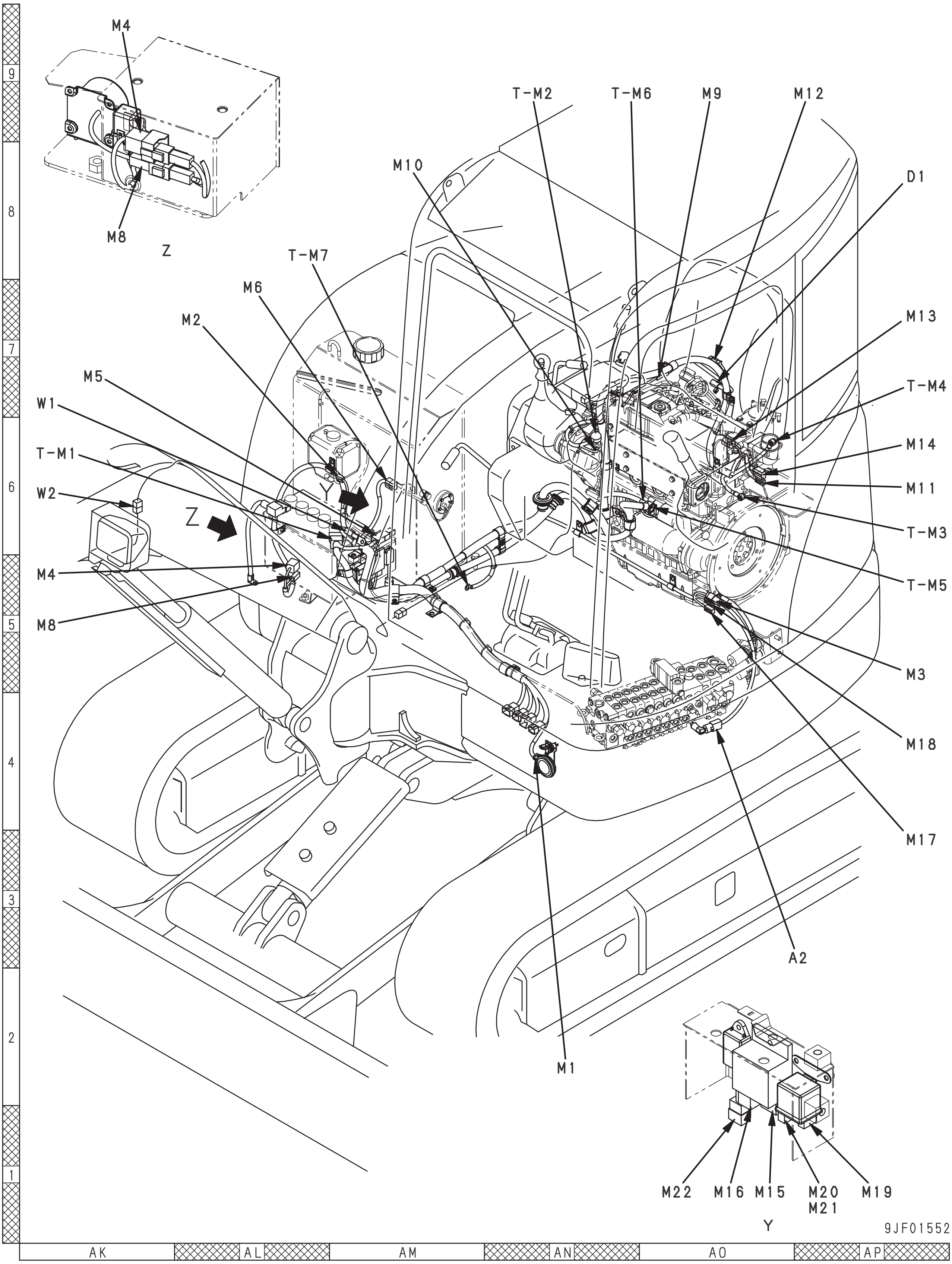
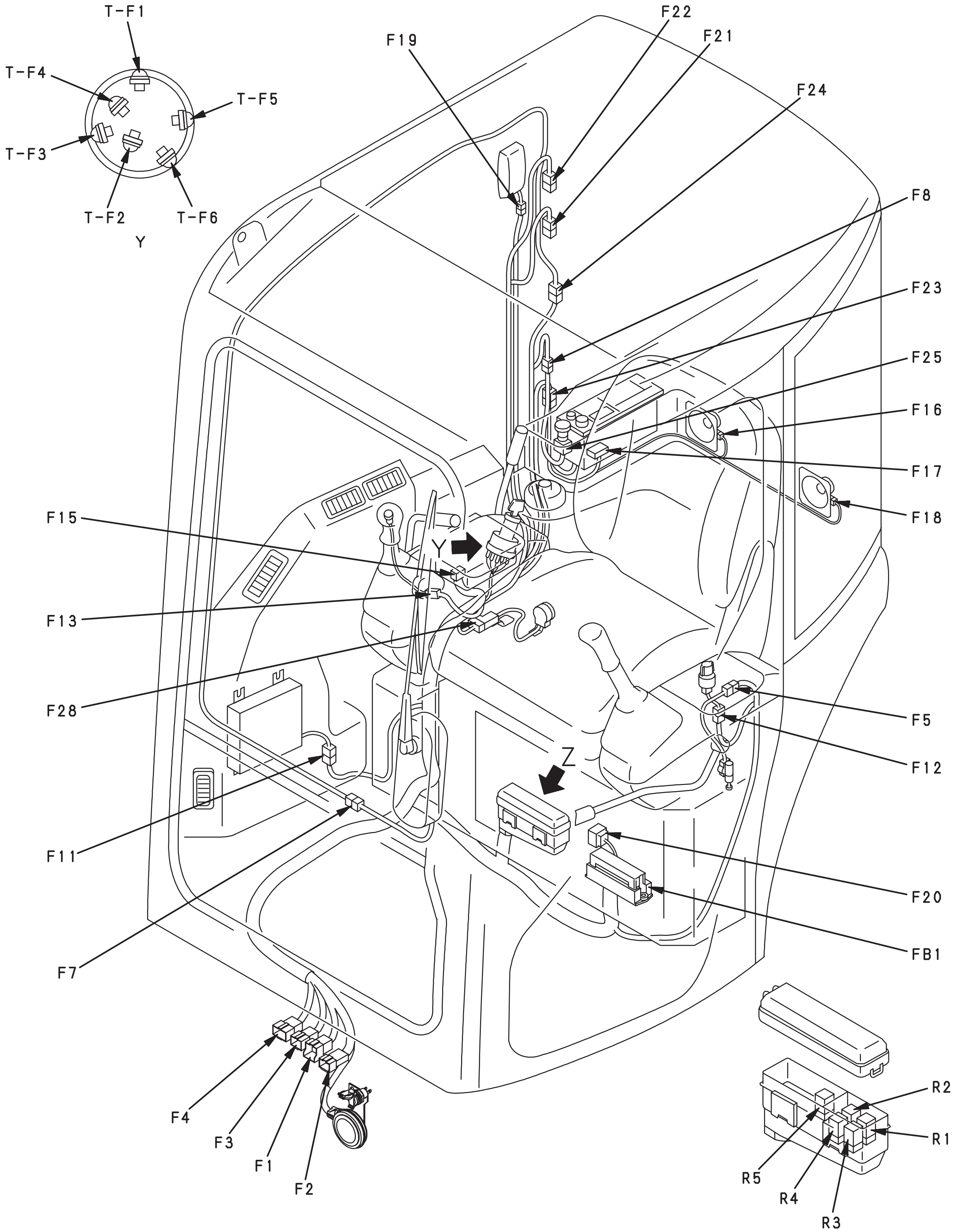
PC40, 50MR-2

Cab specification

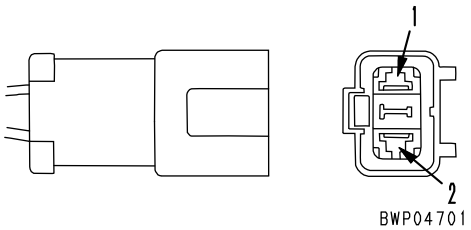
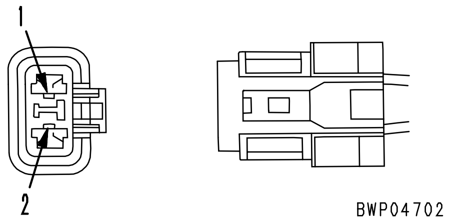
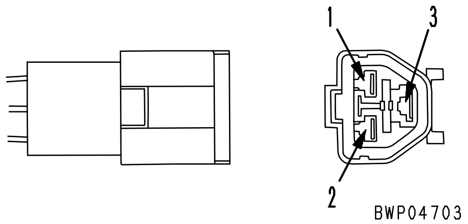
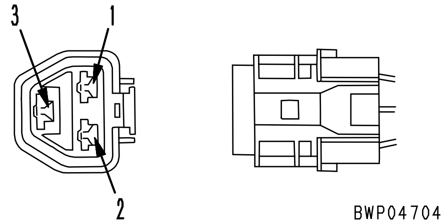
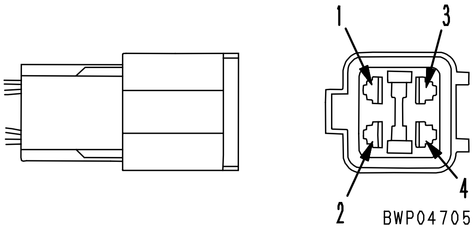
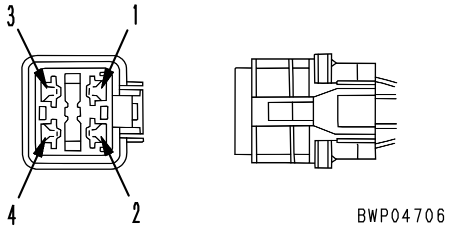


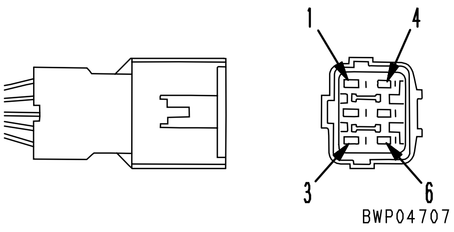
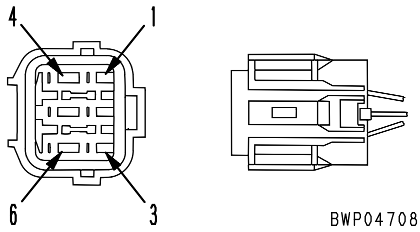
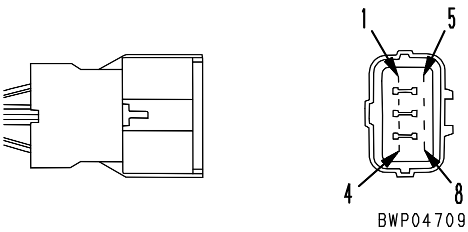
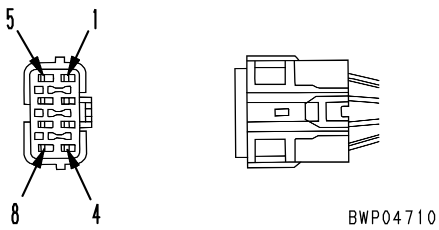
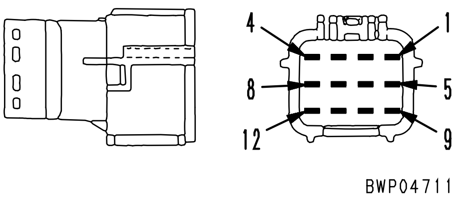
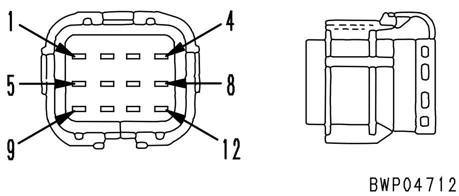
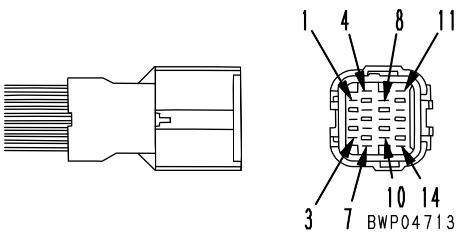
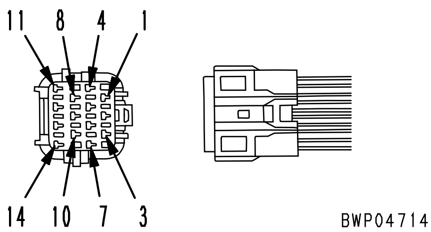


AQ	AR	AS	AT	AU	AV

CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

No.of pins	X type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No.: 08055-00181	Part No.: 08055-00191	799-601-7010
2			799-601-7020
	Part No.: 08055-00282	Part No.: 08055-00292	
3			799-601-7030
	Part No.: 08055-00381	Part No.: 08055-00391	
4			799-601-7040
	Part No.: 08055-00481	Part No.: 08055-00491	
—	Terminal part No.: 79A-222-3370 • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	Terminal part No.: 79A-222-3390 • Electric wire size: 0.85 • Grommet: Black • Q'ty : 20	—
—	Terminal part No.: 79A-222-3380 • Electric wire size: 2.0 • Grommet: Red • Q'ty: 20	Terminal part No.: 79A-222-3410 • Electric wire size: 2.0 • Grommet: Red • Q'ty: 20	—

No.of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
6			799-601-7050
	Part No.: 08055-10681	Part No.: 08055-10691	
8			799-601-7060
	Part No.: 08055-10881	Part No.: 08055-10891	
12			799-601-7310
	Part No.: 08055-11281	Part No.: 08055-11291	
14			799-601-7070
	Part No.: 08055-11481	Part No.: 08055-11491	

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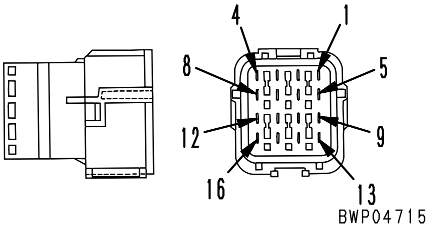
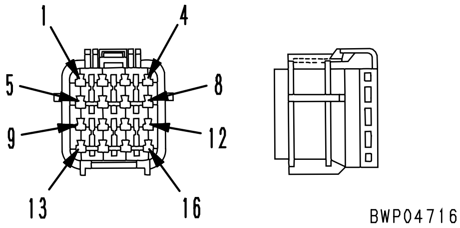
<tr><td rowspan="2">16</td><td>
</td><td>
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<tr><td>Part No.: 08055-11681</td><td>Part No.: 08055-11691</td></tr>
<tr><td>—</td><td>Terminal part No.:
• Electric wire size: 0.85
• Grommet: Black
• Q’ty: 20</td><td>Terminal part No.:
• Electric wire size: 0.85
• Grommet: Black
• Q’ty: 20</td><td>—</td></tr>
<tr><td>—</td><td>Terminal part No.:
• Electric wire size: 1.25
• Grommet: Red
• Q’ty: 20</td><td>Terminal part No.:
• Electric wire size: 1.25
• Grommet: Red
• Q’ty: 20</td><td>—</td></tr>
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No.of pins	M type connector		
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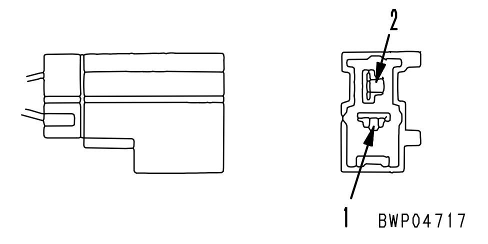
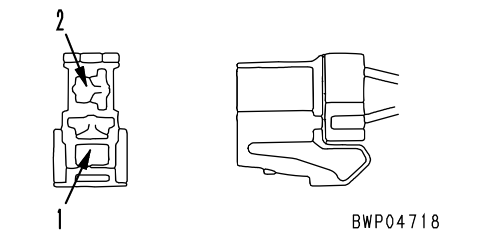
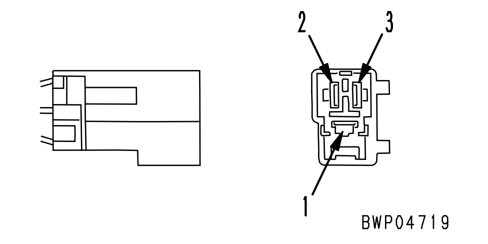
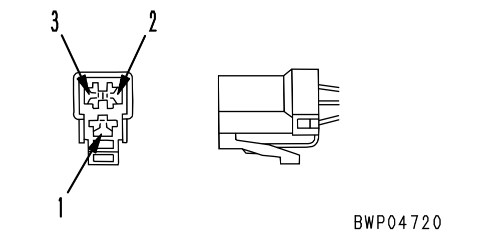
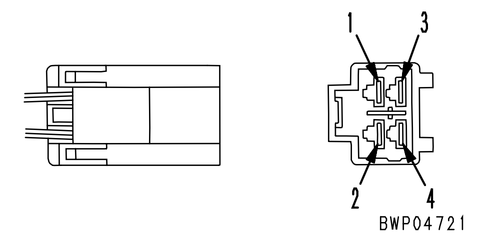
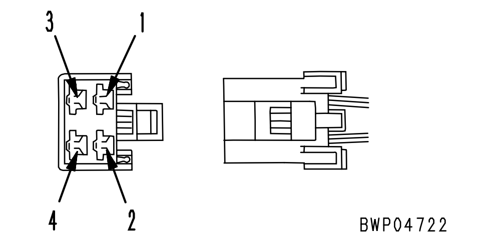
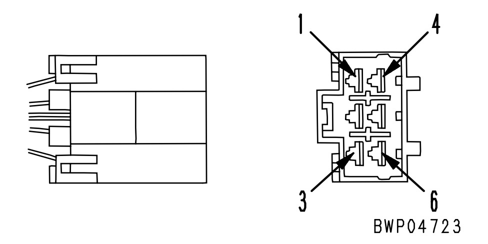
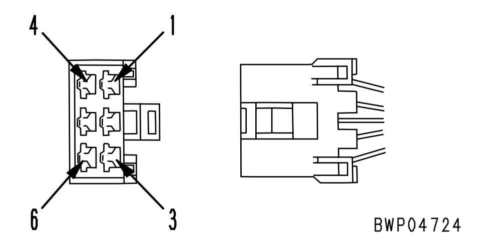
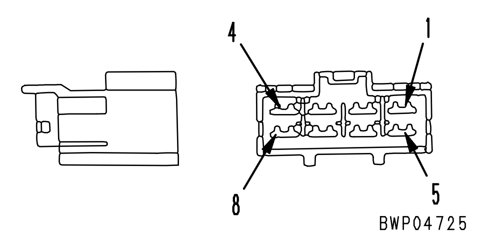
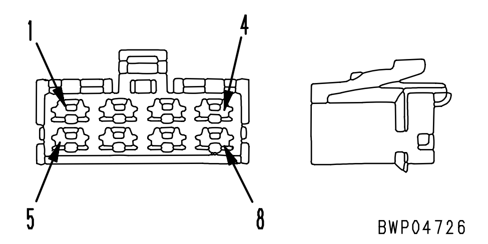
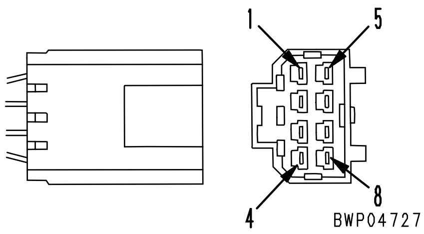
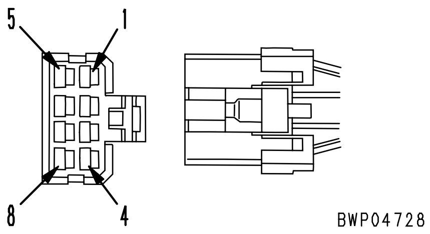
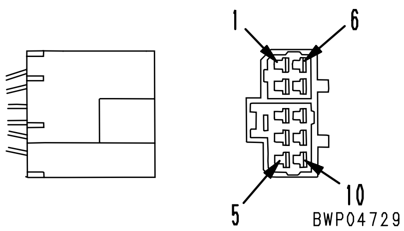
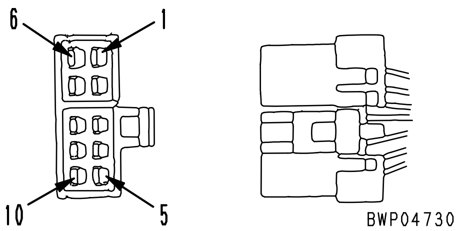
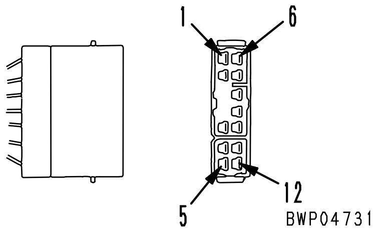
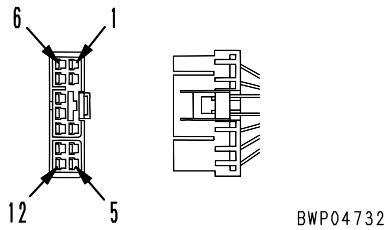
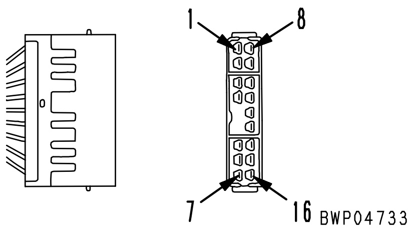
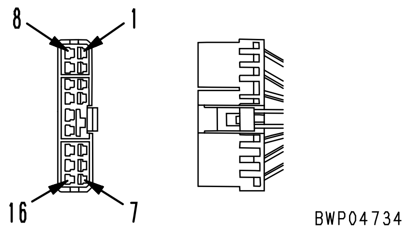
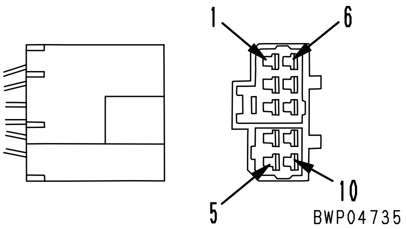
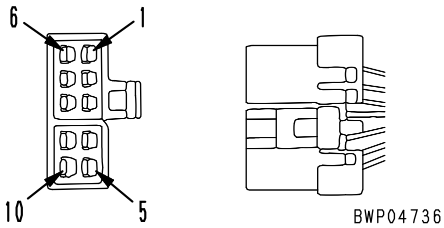
2			799-601-7090
	Part No.: 08056-00271	Part No.: 08056-00281	
3			799-601-7110
	Part No.: 08056-00371	Part No.: 08056-00381	
4			799-601-7120
	Part No.: 08056-00471	Part No.: 08056-00481	
6			799-601-7130
	Part No.: 08056-00671	Part No.: 08056-00681	
8			799-601-7340
	Part No.: 08056-00871	Part No.: 08056-00881	

No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7140
	Part No.: 08056-10871	Part No.: 08056-10881	
10 (White)			799-601-7150
	Part No.: 08056-11071	Part No.: 08056-11081	
12 (White)			799-601-7350
	Part No.: 08056-11271	Part No.: 08056-11281	
16 (White)			799-601-7330
	Part No.: 08056-11671	Part No.: 08056-11681	

No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
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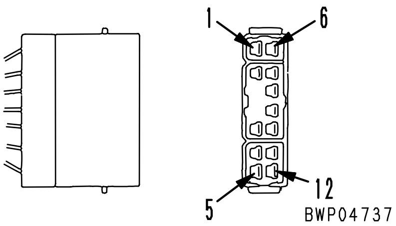
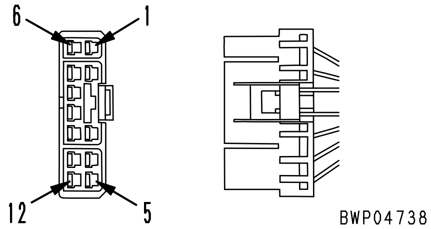
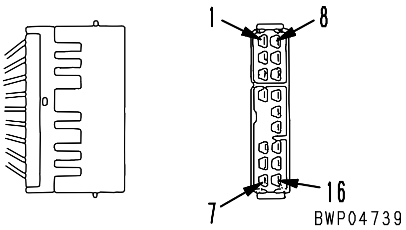
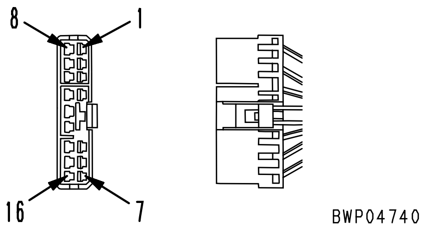
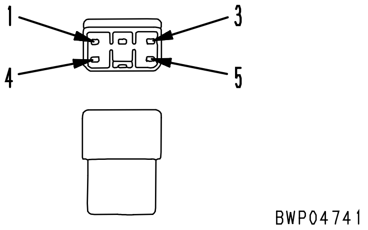
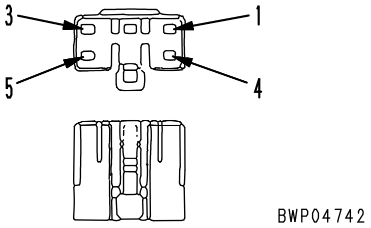
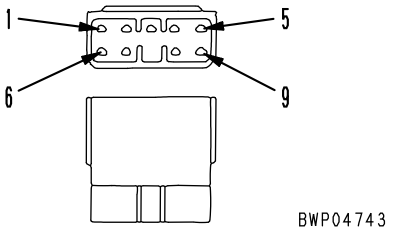
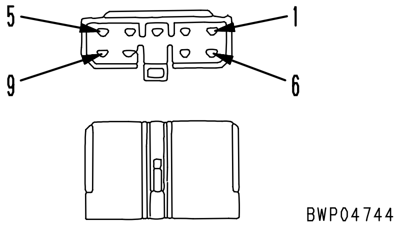
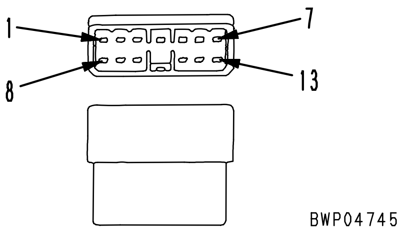
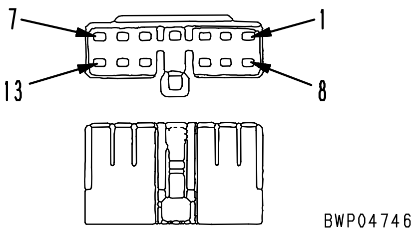
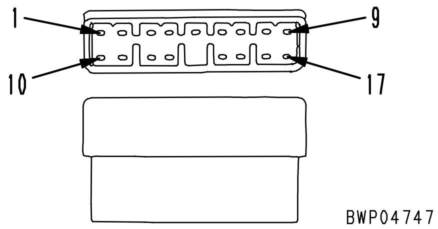
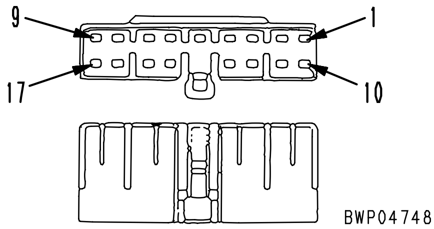
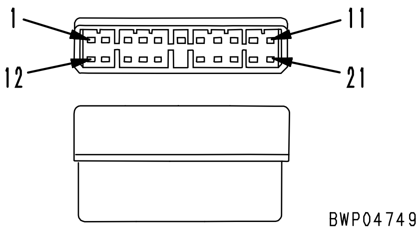
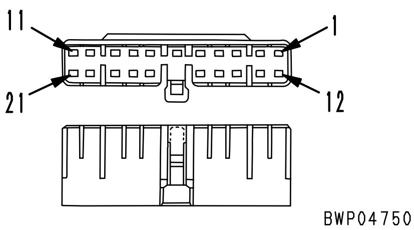
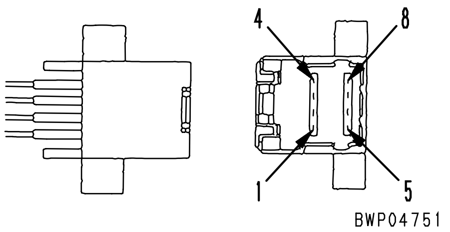
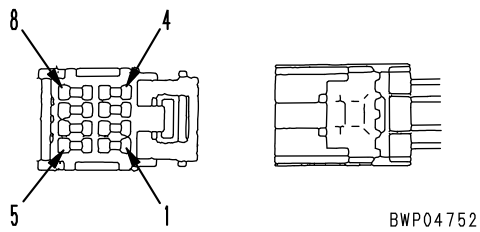
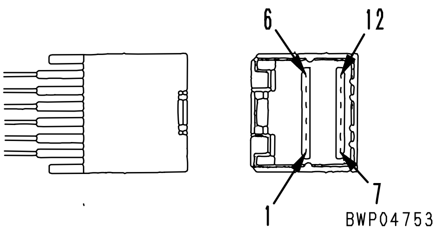
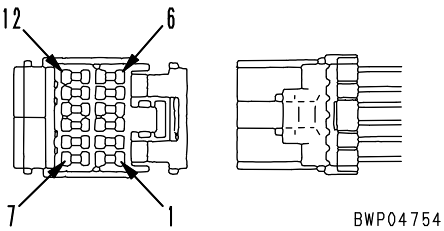
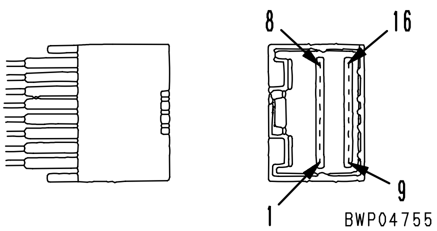
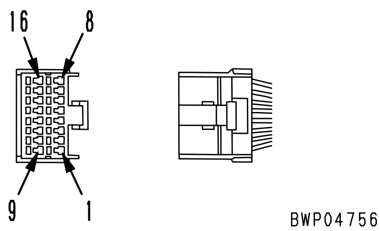
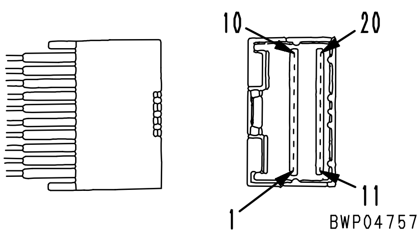
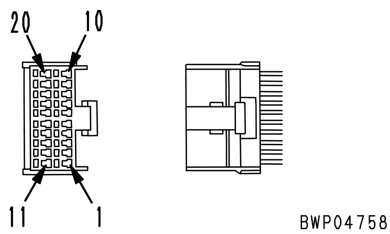
12 (Blue)			799-601-7160
	Part No.: 08056-11272	Part No.: 08056-11282	
16 (Blue)			799-601-7170
	Part No.: 08056-11672	Part No.: 08056-11682	

No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
7	Body part No.: 79A-222-2640 (Q'ty: 5)	Body part No.: 79A-222-2630 (Q'ty: 5)	—
11	Body part No.: 79A-222-2680 (Q'ty: 5)	Body part No.: 79A-222-2670 (Q'ty: 5)	—
5			799-601-2710
	Body part No.: 79A-222-2620 (Q'ty: 5)	Body part No.: 79A-222-2610 (Q'ty: 5)	
9			799-601-2950
	Body part No.: 79A-222-2660 (Q'ty: 5)	Body part No.: 79A-222-2650 (Q'ty: 5)	
13			799-601-2720
	Body part No.: 79A-222-2710 (Q'ty: 2)	Body part No.: 79A-222-2690 (Q'ty: 2)	

No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17			799-601-2730
	Body part No.: 79A-222-2730 (Q'ty: 2)	Body part No.: 79A-222-2720 (Q'ty: 2)	
21			799-601-2740
	Body part No.: 79A-222-2750 (Q'ty: 2)	Body part No.: 79A-222-2740 (Q'ty: 2)	
	Terminal part No.: 79A-222-2770 (Q'ty: 50)	Terminal part No.: 79A-222-2760 (Q'ty: 50)	—

No.of pins	AMP040 type connector		T-adapter Part No.
	Male (female housing)	Female (male housing)	
8			799-601-7180
	—	Housing part No.: 79A-222-3430 (Q’ty: 5)	
12			799-601-7190
	—	Housing part No.: 79A-222-3440 (Q’ty: 5)	
16			799-601-7210
	—	Housing part No.: 79A-222-3450 (Q’ty: 5)	
20			799-601-7220
	—	Housing part No.: 79A-222-3460 (Q’ty: 5)	

★ Terminal part No.: 79A-222-3470 (No relation with number of pins)

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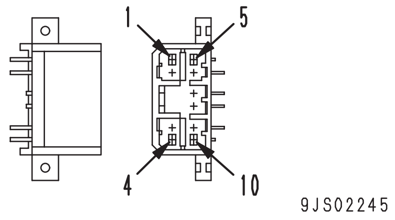
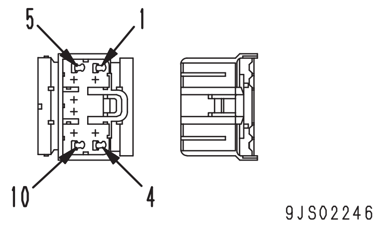
<tr><td rowspan="2">10</td><td>
</td><td>
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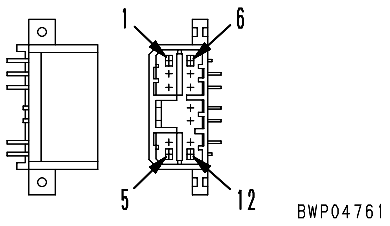
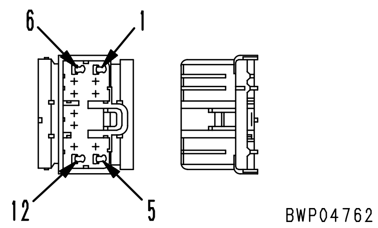
<tr><td rowspan="2">12</td><td>
</td><td>
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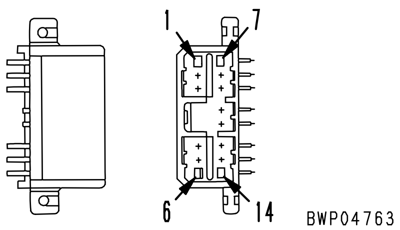
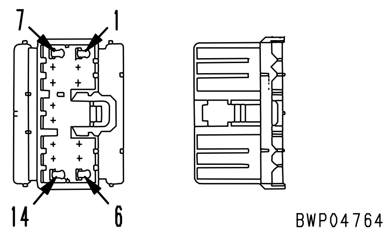
<tr><td rowspan="2">14</td><td>
</td><td>
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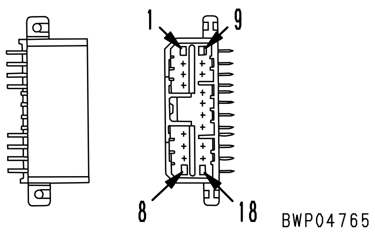
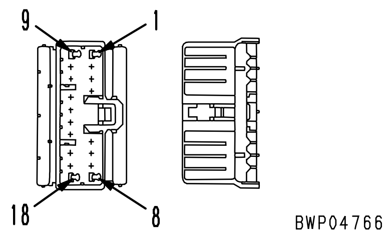
<tr><td rowspan="2">18</td><td>
</td><td>
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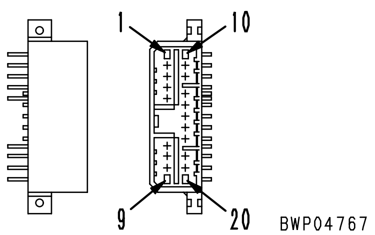
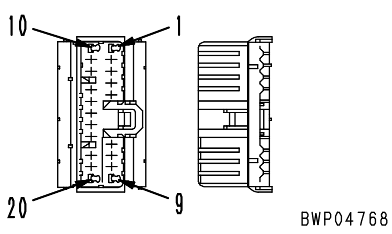
<tr><td rowspan="2">20</td><td>
</td><td>
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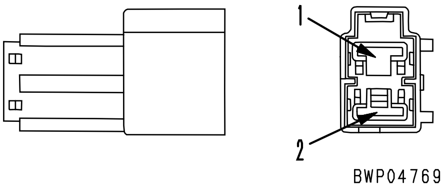
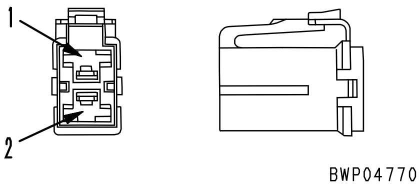
No.of pins	L type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2			—
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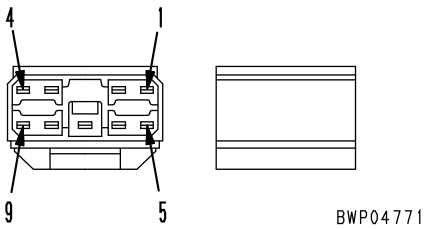
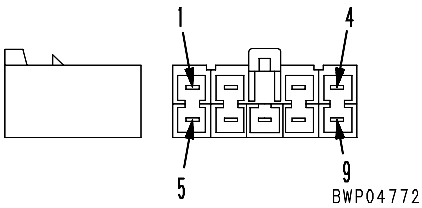
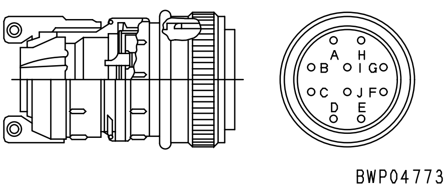
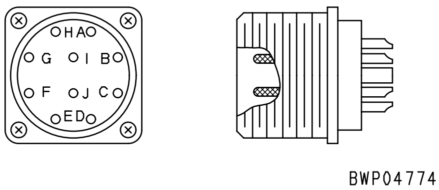
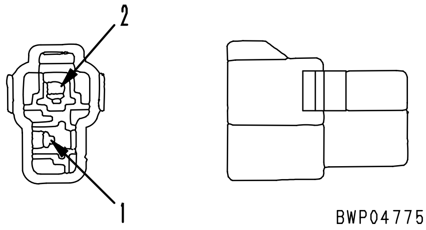
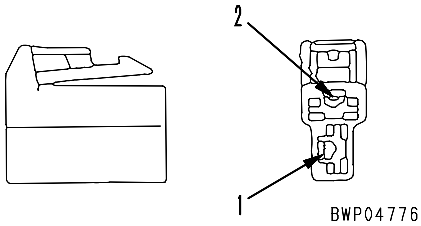
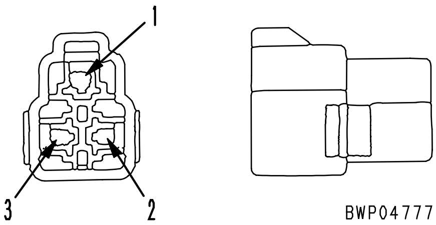
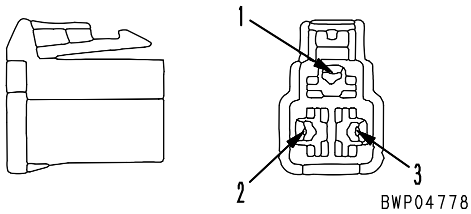
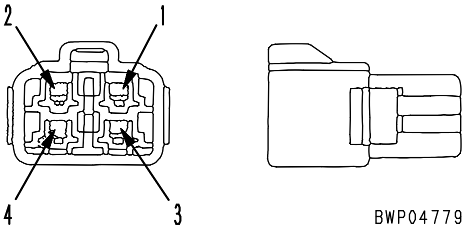
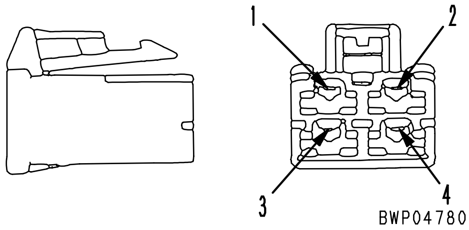
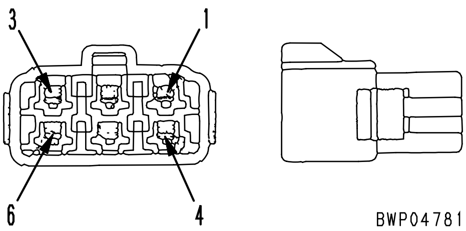
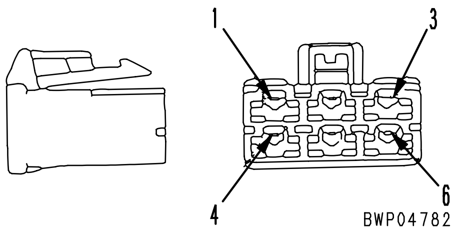
No.of pins	Connector for PA		
	Male (female housing)	Female (male housing)	T-adapter Part No.
9			—
	—	—	

No.of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10			799-601-3460
	—	—	

<table>
<tr><th rowspan="2">No.of pins</th><th colspan="2">KES 1 (Automobile) connector</th><th rowspan="2">T-adapter Part No.</th></tr>
<tr><th>Male (female housing)</th><th>Female (male housing)</th></tr>
<tr><td rowspan="2">2</td><td></td><td></td><td rowspan="2">—</td></tr>
<tr><td>Part No.: 08027-10210 (Natural color)
08027-10220 (Black)</td><td>Part No.: 08027-10260 (Natural color)
08027-10270 (Black)</td></tr>
<tr><td rowspan="2">3</td><td></td><td></td><td rowspan="2">—</td></tr>
<tr><td>Part No.:08027-10310</td><td>Part No.:08027-10360</td></tr>
<tr><td rowspan="2">4</td><td></td><td></td><td rowspan="2">—</td></tr>
<tr><td>Part No.: 08027-10410 (Natural color)
08027-10420 (Black)</td><td>Part No.: 08027-10460 (Natural color)
08027-10470 (Black)</td></tr>
<tr><td rowspan="2">6</td><td></td><td></td><td rowspan="2">—</td></tr>
<tr><td>Part No.: 08027-10610 (Natural color)
08027-10620 (Black)</td><td>Part No.: 08027-10660 (Natural color)
08027-10670 (Black)</td></tr>
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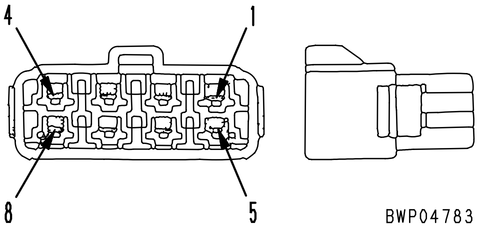
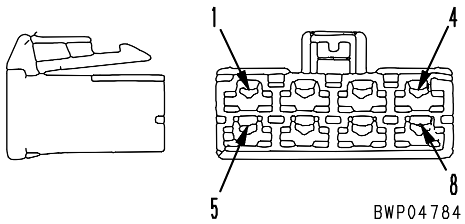
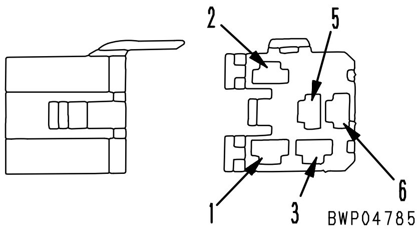
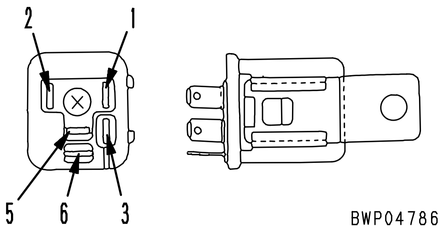
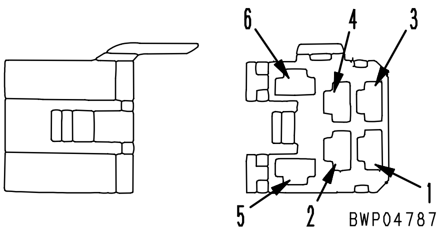
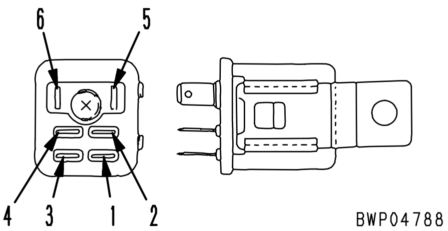
No.of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			—
	Part No.: 08027-10810 (Natural color) 08027-10820 (Black)	Part No.: 08027-10860 (Natural color) 08027-10870 (Black)	

No.of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5			799-601-7360
	—	—	
6			799-601-7370
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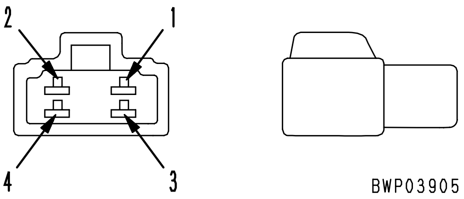
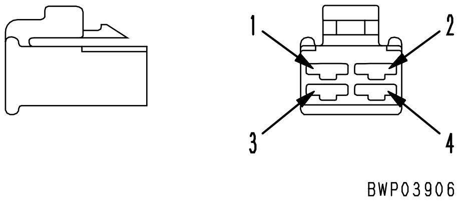
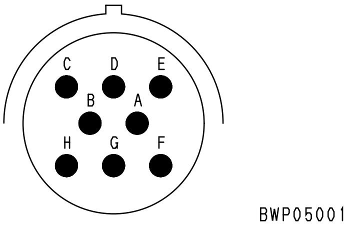
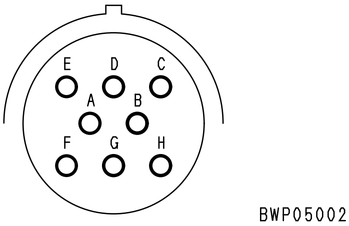
No.of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4			—
	—	—	

[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><th rowspan="2">Type (shell size code)</th><th colspan="3">HD30 Series connector</th></tr>
<tr><th>Body (plug)</th><th>Body (receptacle)</th><th>T-adapter Part No.</th></tr>
<tr><td rowspan="6">18-8
(1)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td>
</td><td>
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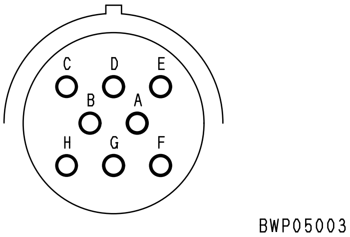
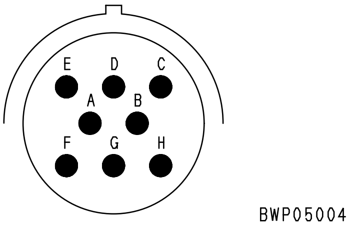
<tr><td>Part No.: 08191-11201, 08191-11202,
08191-11205, 08191-11206</td><td>Part No.: 08191-14101, 08191-14102,
08191-14105, 08191-14106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td>
</td><td>
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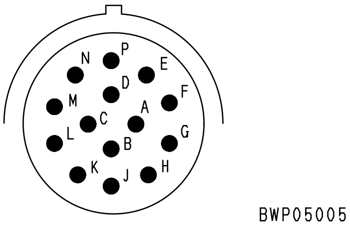
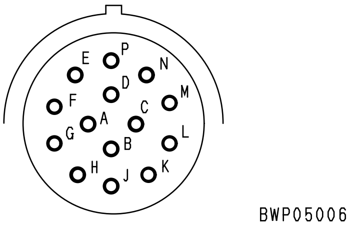
<tr><td>Part No.: 08191-12201, 08191-12202,
08191-12205, 08191-12206</td><td>Part No.: 08191-13101, 08191-13102,
08191-13105, 08191-13106</td></tr>
<tr><td rowspan="6">18-14
(2)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9220</td></tr>
<tr><td>
</td><td>
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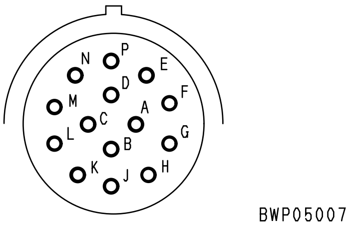
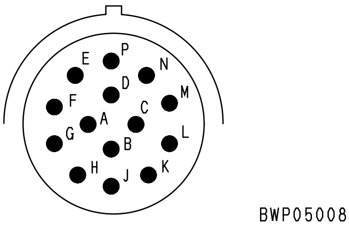
<tr><td>Part No.: 08191-21201, 08191-12202,
08191-21205, 08191-12206</td><td>Part No.: 08191-24101, 08191-24102,
08191-24105, 08191-24106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9220</td></tr>
<tr><td>
</td><td>
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<tr><td>Part No.: 08191-22201, 08191-22202,
08191-22205, 08191-22206</td><td>Part No.: 08191-23101, 08191-23102,
08191-23105, 08191-23106</td></tr>
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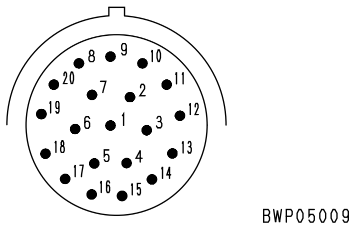
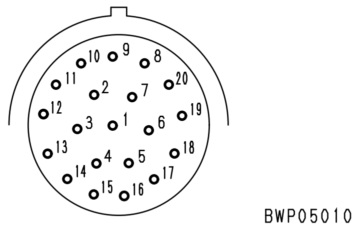
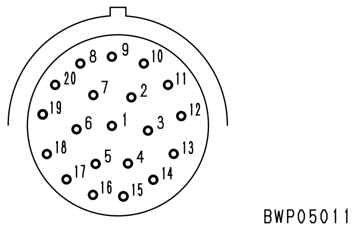
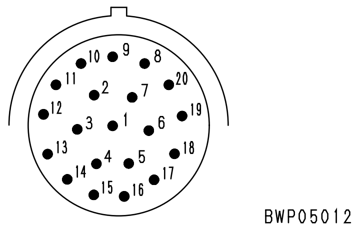
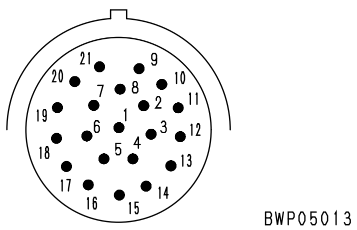
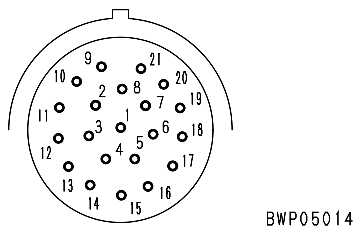
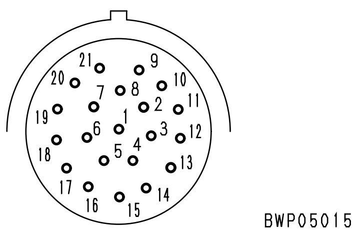
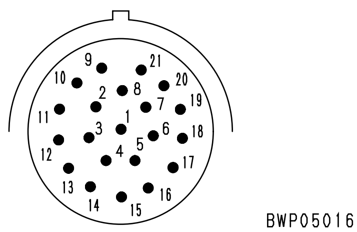
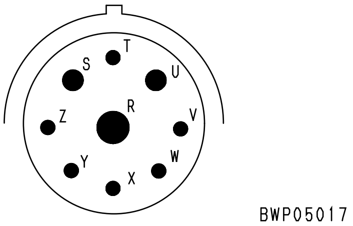
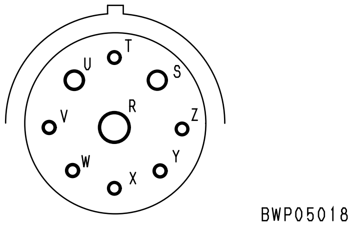
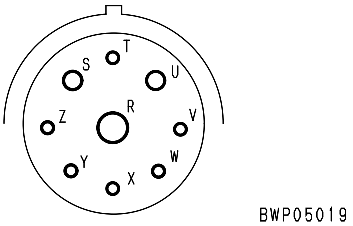
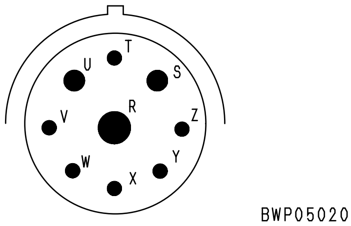
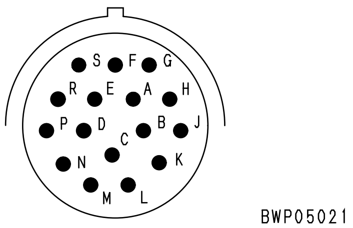
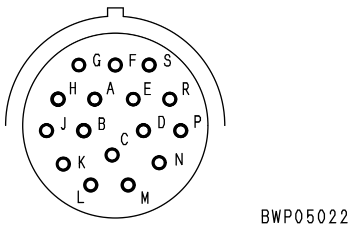
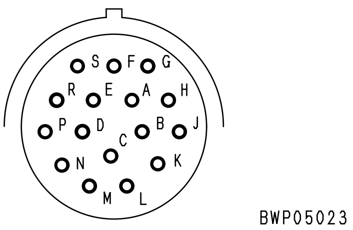
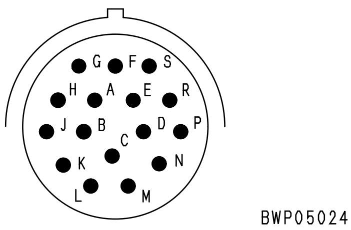
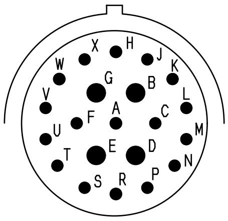
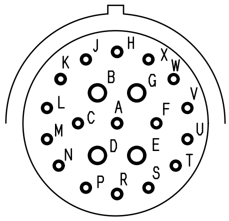
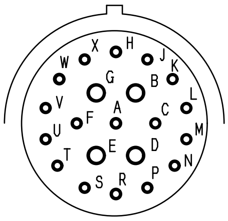
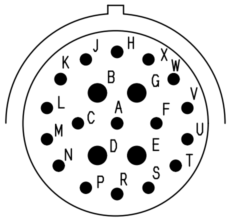
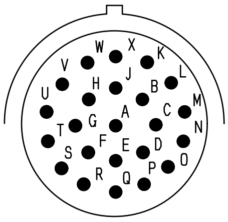
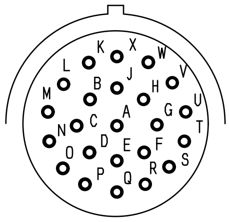
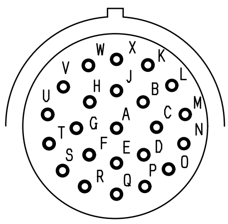
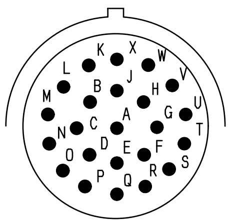
[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-20 (3)	Pin (male terminal)	Pin (female termial)	799-601-9230
			
	Part No.:08191-31201, 08191-31202	Part No.:08191-34101, 08191-34102	
	Pin (female terminal)	Pin (male termial)	799-601-9230
			
	Part No.:08191-32201, 08191-32202	Part No.:08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Pin (female termial)	799-601-9240
			
	Part No.:08191-41201, 08191-42202	Part No.:08191-44101, 08191-44102	
	Pin (female terminal)	Pin (male termial)	799-601-9240
			
	Part No.:08191-42201, 08191-42202	Part No.:08191-43101, 08191-43102	

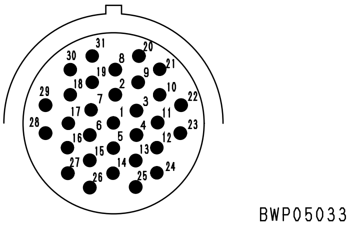
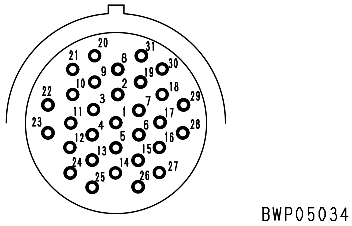
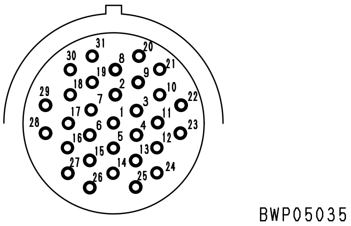
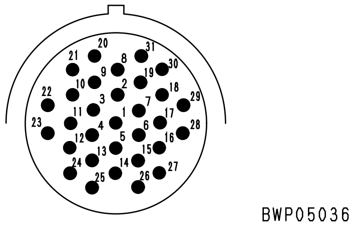
[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-9 (5)	Pin (male terminal)	Pin (female termial)	799-601-9250
			
	Part No.:08191-51201, 08191-51202	Part No.:08191-54101, 08191-54102	
	Pin (female terminal)	Pin (male termial)	799-601-9250
			
	Part No.:08191-52201, 08191-52202	Part No.:08191-53101, 08191-53102	
24-16 (6)	Pin (male terminal)	Pin (female termial)	799-601-9260
			
	Part No.: 08191-61201, 08191-62202, 08191-61205, 08191-62206	Part No.: 08191-64101, 08191-64102, 08191-64105, 08191-64106	
	Pin (female terminal)	Pin (male termial)	799-601-9260
			
	Part No.: 08191-62201, 08191-62202, 08191-62205, 08191-62206	Part No.: 08191-63101, 08191-63102, 08191-63105, 08191-63106	

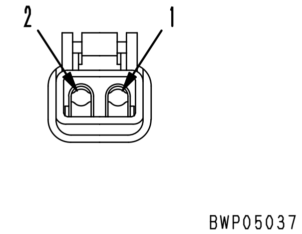
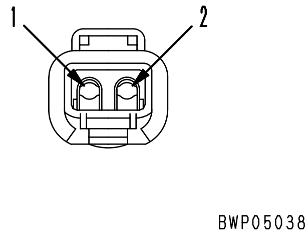
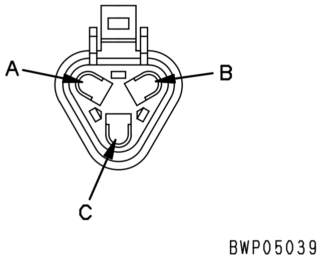
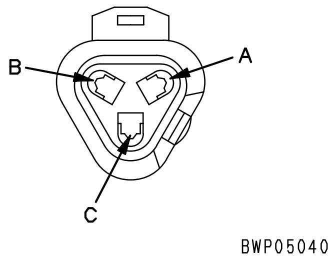
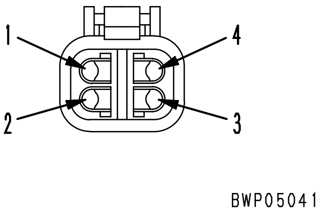
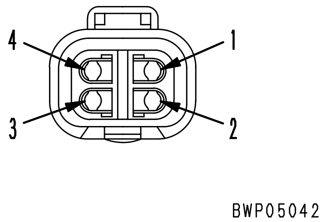
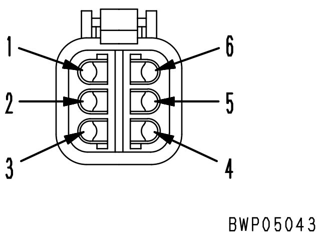
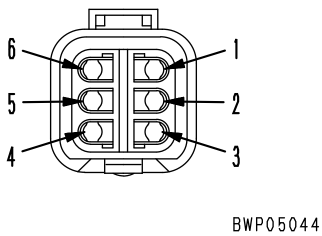
[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-21 (7)	Pin (male terminal)	Pin (female termial)	799-601-9270
	 BWP05025	 BWP05026	
	Part No.: 08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No.: 08191-74101, 08191-74102, 08191-74105, 08191-74106	
	Pin (female terminal)	Pin (male termial)	799-601-9270
	 BWP05027	 BWP05028	
	Part No.: 08191-72201, 08191-72202, 08191-72205, 08191-72206	Part No.: 08191-73101, 08191-73102, 08191-73105, 08191-73106	
24-23 (8)	Pin (male terminal)	Pin (female termial)	799-601-9280
	 BWP05029	 BWP05030	
	Part No.: 08191-81201, 08191-81202 08191-81203, 08191-81204 08191-81205, 08191-80206	Part No.: 08191-84101, 08191-84102 08191-84103, 08191-84104 08191-84105, 08191-84106	
	Pin (female terminal)	Pin (male termial)	799-601-9280
	 BWP05031	 BWP05032	
	Part No.: 08191-82201, 08191-82202 08191-82203, 08191-82204 08191-82205, 08191-82206	Part No.: 08191-83101, 08191-83102 08191-83103, 08191-83104 08191-83105, 08191-83106	

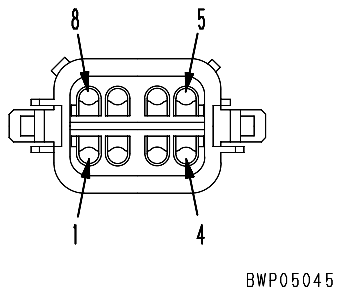
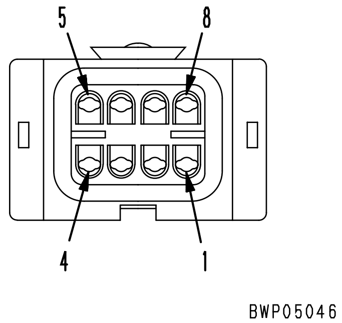
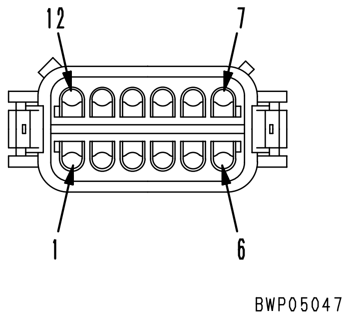
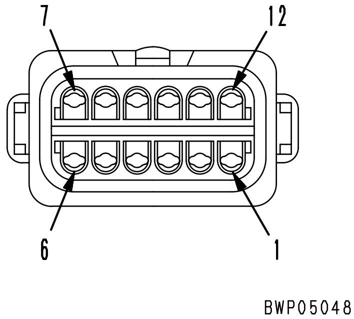
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="6">24-31
(9)</td><td>Pin (male termial)</td><td>Pin (female terminal)</td><td rowspan="3">799-601-9290</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Part No.: 08191-91203, 08191-91204, 08191-91205, 08191-91206</td><td>Part No.: 08191-94103, 08191-94104, 08191-94105, 08191-94106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9290</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Part No.: 08191-92203, 08191-92204, 08191-92205, 08191-92206</td><td>Part No.: 08191-93103, 08191-93104, 08191-93105, 08191-93106</td></tr>
</table>

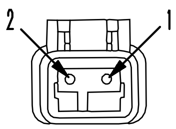
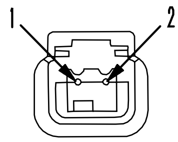
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2			799-601-9020
	Part No.: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No.: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3			799-601-9030
	Part No.: 08192-13200 (normal type) 08192-23200 (fine wire type)	Part No.: 08192-13100 (normal type) 08192-23100 (fine wire type)	
4			799-601-9040
	Part No.: 08192-14200 (normal type) 08192-24200 (fine wire type)	Part No.: 08192-14100 (normal type) 08192-24100 (fine wire type)	
6			799-601-9050
	Part No.: 08192-16200 (normal type) 08192-26200 (fine wire type)	Part No.: 08192-16100 (normal type) 08192-26100 (fine wire type)	

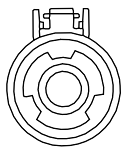
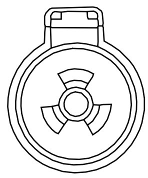
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
8			8GR: 799-601-9060 8B: 799-601-9070 8G: 799-601-9080 8BR: 799-601-9090
	Part No.: 08192-1820□ (normal type) 08192-2820□ (fine wire type)	Part No.: 08192-1810□ (normal type) 08192-2810□ (fine wire type)	
12			12GR: 799-601-9110 12B: 799-601-9120 12G: 799-601-9130 12BR: 799-601-9140
	Part No.: 08192-1920□ (normal type) 08192-2920□ (fine wire type)	Part No.: 08192-1910□ (normal type) 08192-2910□ (fine wire type)	

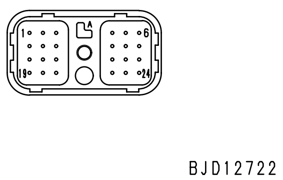
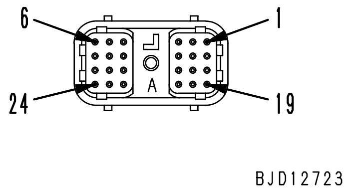
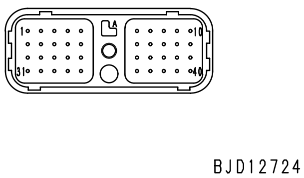
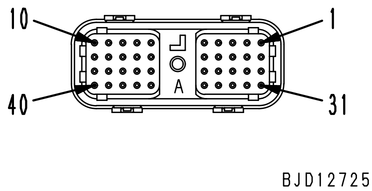
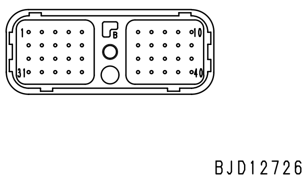
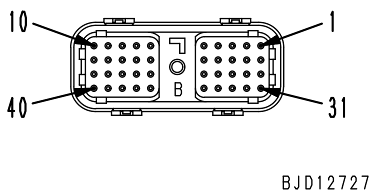
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05049	 BWP05050	799-601-9010
	Part No.: 08192-02200	Part No.: 08192-02100	

[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
1	 BWP05051	 BWP05052	—
	Part No.: 08192-31200 (Contact size#12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No.: 08192-31100 (Contact size#12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><th rowspan="2">No.of pins</th><th colspan="3">DRC26 Series connector</th></tr>
<tr><th>Body (plug)</th><th>Body (receptacle)</th><th>T-adapter Part No.</th></tr>
<tr><td rowspan="2">24</td><td></td><td></td><td rowspan="2">799-601-9360</td></tr>
<tr><td>—</td><td>Part No. : 7821-93-3110</td></tr>
<tr><td rowspan="2">40
(A)</td><td></td><td></td><td rowspan="2">799-601-9350</td></tr>
<tr><td>—</td><td>Part No. : 7821-93-3120</td></tr>
<tr><td rowspan="2">40
(B)</td><td></td><td></td><td rowspan="2">799-601-9350</td></tr>
<tr><td>—</td><td>Part No. : 7821-93-3130</td></tr>
</table>

T-ADAPTER - BOXES AND T-ADAPTER TABLE

★ The part Nos. of the T-adapter boxes and T-adapters are shown in the columns and those of the wiring harness checker assemblies are shown in the lines.

			KIT Part No.																	
Part No.	Type of connector	No. of pins	799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	—
799-601-2600	Box for measurement	Econo-21P	○		○	○						○	○		○					
799-601-3100	Box for measurement	MS-37P					○													
799-601-3200	Box for measurement	MS-37P					○													
799-601-3300	Box for measurement	Econo-24P							○											
799-601-3360	Plate	For MS box																		
799-601-3370	Plate	For MS box																		
799-601-3380	Plate	For MS box																		
799-601-3410	BENDIX(MS)	24P							○	○										
799-601-3420	BENDIX(MS)	24P							○	○										
799-601-3430	BENDIX(MS)	17P							○	○										
799-601-3440	BENDIX(MS)	17P							○	○										
799-601-3450	BENDIX(MS)	5P						○	○											
799-601-3460	BENDIX(MS)	10P							○	○										
799-601-3510	BENDIX(MS)	5P						○	○											
799-601-3520	BENDIX(MS)	14P						○	○											
799-601-3530	BENDIX(MS)	19P							○	○										
799-601-2910	BENDIX(MS)	14P						○	○											
799-601-3470	Case								○											
799-601-2710	MIC	5P	○	○		○							○							
799-601-2720	MIC	13P	○	○		○							○							
799-601-2730	MIC	17P	○	○	○	○						○	○		○					
799-601-2740	MIC	21P	○	○	○	○						○	○		○					
799-601-2950	MIC	9P									○	○	○		○					
799-601-2750	ECONO	2P	○	○																
799-601-2760	ECONO	3P	○	○																
799-601-2770	ECONO	4P	○	○																
799-601-2780	ECONO	8P	○	○																
799-601-2790	ECONO	12P	○	○																
799-601-2810	DLI	8P	○	○																
799-601-2820	DLI	12P	○	○																
799-601-2830	DLI	16P	○	○																
799-601-2840	Extension cable		○	○									○							
799-601-2850	Case		○																	
799-601-7010	X	1P											○		○					
799-601-7020	X	2P									○	○	○		○					
799-601-7030	X	3P									○	○	○		○					
799-601-7040	X	4P									○	○	○		○					
799-601-7050	SWP	6P									○	○	○							
799-601-7060	SWP	8P									○	○	○							
799-601-7310	SWP	12P																		○
799-601-7070	SWP	14P											○		○					

			KIT Part No.																	
Part No.	Type of connector	No. of pins	799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	—
799-601-7320	SWP	16P																		○
799-601-7080	M	1P											○		○					
799-601-7090	M	2P									○	○	○		○					
799-601-7110	M	3P									○	○	○		○					
799-601-7120	M	4P									○	○	○		○					
799-601-7130	M	6P									○	○	○		○					
799-601-7340	M	8P																		○
799-601-7140	S	8P									○	○	○		○					
799-601-7150	S	10P-White									○	○	○		○					
799-601-7160	S	12P-Blue									○	○	○							
799-601-7170	S	16P-Blue									○	○	○		○					
799-601-7330	S	16P-White													○					
799-601-7350	S	12P-White																		○
799-601-7180	AMP040	8P											○							
799-601-7190	AMP040	12P											○		○					
799-601-7210	AMP040	16P									○	○	○		○					
799-601-7220	AMP040	20P									○	○	○		○					
799-601-7230	Short connector	X-2									○	○	○		○					
799-601-7240	Case										○	○								
799-601-7270	Case												○							
799-601-7510	070	10P												○						
799-601-7520	070	12P												○						
799-601-7530	070	14P												○						
799-601-7540	070	18P												○						
799-601-7550	070	20P												○						
799-601-7360	Relay connector	5P																		○
799-601-7370	Relay connector	6P																		○
799-601-7380	JFC connector	2P																		○
799-601-9010	DTM	2P														○		○		
799-601-9020	DT	2P														○		○		
799-601-9030	DT	3P														○		○		
799-601-9040	DT	4P														○		○		
799-601-9050	DT	6P														○		○		
799-601-9060	DT	8P-Gray														○		○		
799-601-9070	DT	8P-Black														○		○		
799-601-9080	DT	8P-Green														○		○		
799-601-9090	DT	8P-Brown														○		○		
799-601-9110	DT	12P-Gray														○		○		
799-601-9120	DT	12P-Black														○		○		
799-601-9130	DT	12P-Green														○		○		
799-601-9140	DT	12P-Brown														○		○		
799-601-9210	HD30	18-8														○	○			
799-601-9220	HD30	18-14														○	○			
799-601-9230	HD30	18-20														○	○			

			KIT Part No.																	
Part No.	Type of connector	No. of pins	799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	–
799-601-9240	HD30	18-21														○	○			
799-601-9250	HD24	24-9														○	○			
799-601-9260	HD30	24-16														○	○			
799-601-9270	HD30	24-21														○	○			
799-601-9280	HD30	24-23														○	○			
799-601-9290	HD30	24-31														○	○			
799-601-9310	Plate	For HD30														○	○		○	
799-601-9320	Box for measurement	For DT, HD														○	○		○	
799-601-9330	Case															○				
799-601-9340	Case																○			
799-601-9350	DRC26	40P																	○	
799-601-9360	DRC26	24P																	○	
799-601-9410	For NE, G sensor	2P																		○
799-601-9420	For fuel, boost pressure	3P																		○
799-601-9430	PVC socket	2P																		○

TROUBLESHOOTING OF ELECTRICAL SYSTEM (E-MODE)

BEFORE STARTING E-MODE TROUBLESHOOTING 20-302
INFORMATION CONTAINED IN TROUBLESHOOTING TABLE 20-303
E-1 ENGINE DOES NOT START 20-304
E-2 ENGINE DOES NOT STOP 20-312
E-3 WHEN WORK EQUIPMENT LOCK (PPC BASIC PRESSURE LOCK) LEVER IS SET IN LOCK POSITION, WORK EQUIPMENT STILL MOVES 20-316
E-4 WINDSHIELD WIPER DOES NOT OPERATE 20-320
E-5 WINDSHIELD WASHER DOES NOT OPERATE 20-322
E-6 TRAVEL ALARM DOES NOT SOUND 20-326
E-7 DEFECTIVE AIR CONDITIONER 20-330

BEFORE STARTING E-MODE TROUBLESHOOTING

Connection table of fuse box

★ This connection table shows the devices to which each power supply of the fuse box (FB1) supplies power directly (A switch power supply is a device which supplies power while the starting switch is at the ON position and a constant power supply is a device which supplies power while the starting switch is at the OFF position).

★ When carrying out troubleshooting related to the electric system, you should check the fuse box and fusible link to see if the power is supplied normally.

Type of power supply	Fuse No.	Fuse capacity	Destination of power
Switch power supply	1	30A	Engine stop solenoid
	2	10A	Safety relay
			Fuel pump
			PPC lock solenoid relay
			Horn switch
	3	10A	Monitor
			Alarm buzzer
			2nd travel speed selection solenoid relay, PPC lock switch
	4	10A	Arm crane
			—
	5	10A	Air conditioner, heater
			Travel alarm
	6	20A	Room lamp
			Radio
			Wiper motor
			Windshield washer motor
Constant power supply (fusible link 45A: M4)	7	10A	Radio
			Monitor panel
			Arm crane controller
	8	10A	Working lamp relay
—	9	—	(Spare)
	10	—	(Spare)

INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

Failure information	Phenomena occurring on machine
Relative information	Information on the failure occurred as well as the troubleshooting

<table>
<tr><td rowspan="4">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td rowspan="3">Cause that presumably triggered failure in question
(The assigned No. is for filing purpose only. It does not stand for any priority)</td><td rowspan="3"><Content Included>
• Standard value in normalcy by which to pass "Good" or "No good" judgement over the presumed cause
• Reference for passing the above "Good" or "No Good" judgement

<Phenomenon of Wiring Harness Failure>
• Disconnection
There is a faulty contact at the connector or disconnection of wiring harness occurred.
• Defective grounding
A wiring harness that is not connected with a grounding circuit has a contact with the grounding circuit.
• Short-circuiting
A wiring harness that is not connected with a 12 V electric circuit has a contact with the electric circuit.

<Precaution for Troubleshooting>
1) Connector No. display method and handling of T-adapter
Insert or connect T-adapters in the following manner before starting troubleshooting unless otherwise instructed.
• If there is no indication of "male" or "female" in a specific connector No., disconnect the connector and insert the T-adapter into both male and female sides.
• If there is an indication of "male" or "female" in a specific connector No., disconnect the connector and connect the T-adepter with only one side of either "male" or "female".
2) Entry sequence of pin No. and handling of circuit tester lead
Connect the positive (+) lead and the negative (–) lead OFF a circuit tester in the following manner unless otherwise instructed.
• Connect the positive (+) lead with the pin No. indicated at the front or the wiring harness.
• Connect the negative (–) lead with the pin No. indicated at the front or the wiring harness.</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
</table>

Relative circuit diagram

This is part of the electrical circuit diagram which shows the portion where the failure occurred.
• Connector No.: Indicates (Type - numbers of a pin) (color)

E-1 ENGINE DOES NOT START

1) Engine does not start (Starting motor does not rotate)

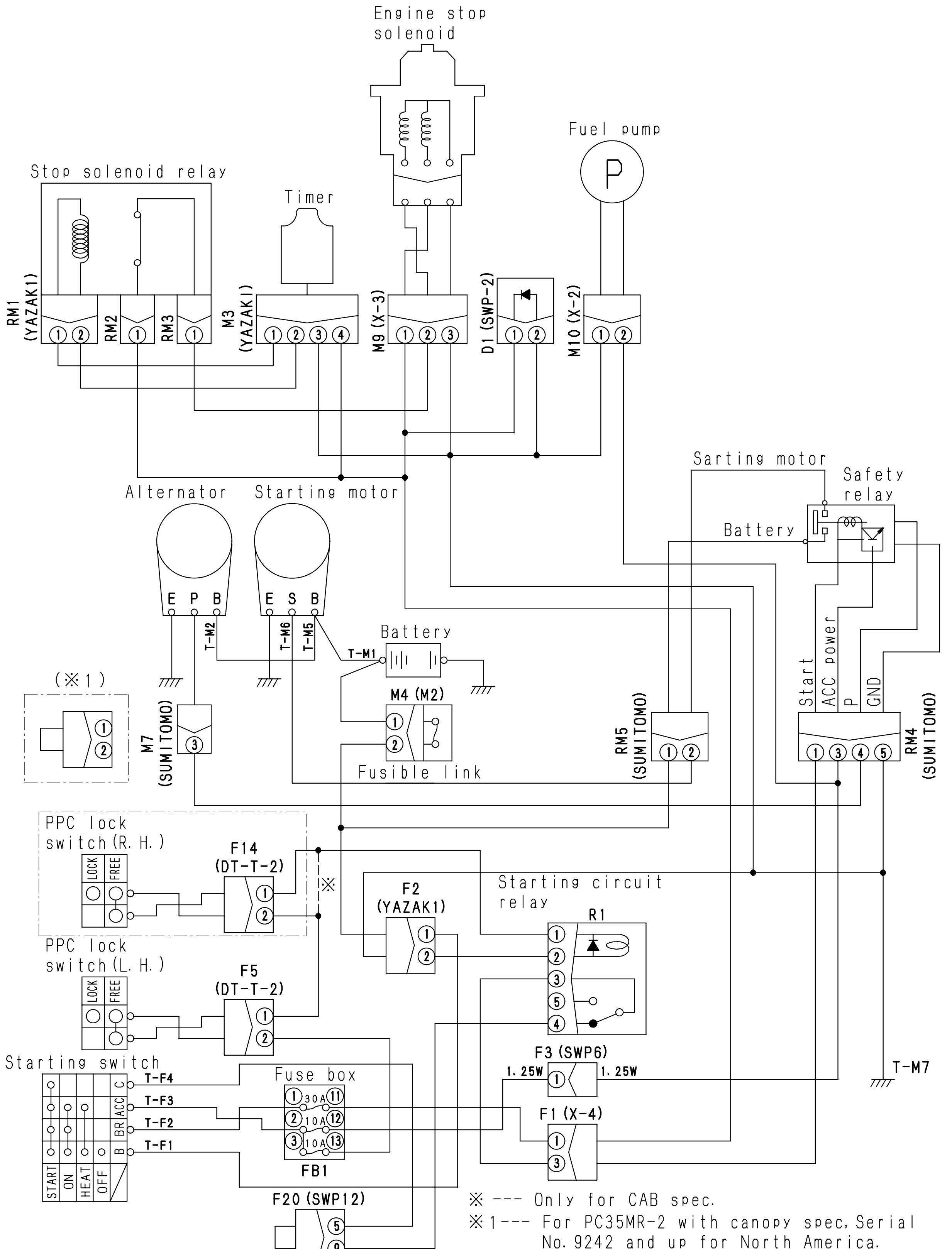
PC27, 30, 35MR-2 (*1): Except PC35MR-2, Serial No. 9242 and up for North America.

Failure information	• Engine does not start (Starting motor does not rotated)
Relative information	• Since the engine starting circuit has a locking function, the engine cannot start if the PPC lock lever (lock lever) is not in the LOCK position. • The lock lever is installed to the right and left side of the canopy specification and to the left side of the cab specification.

<table>
<tr><td rowspan="30">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Insufficient battery capacity</td><td>Battery voltage</td><td colspan="2">Electrolyte specific gravity</td></tr>
<tr><td>Min. 12 V</td><td colspan="2">Min. 1.26</td></tr>
<tr><td>2</td><td>Defective 45-A fusible link or fuse (12) or (13)</td><td colspan="3">If the fusible link or fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Defective starting switch (Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td>Starting switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F4) terminal C</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>START</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F3) terminal ACC</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective PPC lock switch (left)
(Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F5.
3) Connect T-adapter to F5 (male).</td></tr>
<tr><td>F5 (male)</td><td>Lock lever position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>FREE</td><td>Max. 1 Ω</td></tr>
<tr><td>LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective PPC lock switch (right)
(Internal defective contact)
* Only canopy specification (*1)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F14.
3) Connect T-adapter to F14 (male).</td></tr>
<tr><td>F14 (male)</td><td>Lock lever position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>FREE</td><td>Max. 1 Ω</td></tr>
<tr><td>LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="8">6</td><td rowspan="8">Defective starting motor cut-out relay
(Internal disconnection, defective contact, or fixing)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect relay R1.
3) Connect T-adapter to R1 (male).</td></tr>
<tr><td>R1 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (1) and (2)</td><td colspan="2">86 – 106 Ω</td></tr>
<tr><td>Between (3) and (4)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (3) and (5)</td><td colspan="2">Min. 1 M Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch OFF.
2) Insert T-adapter in relay R1.
3) Turn starting switch ON.</td></tr>
<tr><td>R1</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (4) and ground
(Set PPC lock lever in LOCK and starting switch in START)</td><td colspan="2">10 – 15 V</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective starting motor</td><td colspan="3">1) Turn starting switch from OFF to START for troubleshooting.
(If power supply and starting input/output are normal and starting motor does not rotate, starting motor is defective.)</td></tr>
<tr><td>Starting motor</td><td>Starting switch</td><td>Voltage</td></tr>
<tr><td>Power supply: Between terminal B and ground</td><td>ON</td><td>10 – 15 V</td></tr>
<tr><td>Starting input: Between terminal S and ground</td><td>START</td><td>10 – 15 V</td></tr>
</table>

	No.	Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	8	Defective safety relay (Internal defective contact or disconnection)	1) Turn starting switch from OFF to START for troubleshooting.		
			RM5	Voltage	
			Between (2) and ground	10 – 15 V	
	9	Defective alternator (including regulator) (Internal short circuit)	1) Turn starting switch from OFF to ON or START for troubleshooting.		
			Alternator	Voltage	
			Between terminal P and ground	Max. 1 V	
	10	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Wiring harness between battery (+) and M4 (1) or between (2) and T-F1 or RM5 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between T-F3 and fuse (2) or between (12) and F3 (1) and RM4 (3)	Resistance	Max. 1 Ω
			Wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) * Check F14 for only canopy specification.	Resistance	Max. 1 Ω
			Wiring harness between T-F4 and F20 (5) or between (9) and R1 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between R1 (female) (3), F1 (3), and RM4 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between RM4 (female) (4) and M7 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between RM5 (female) (2) and starting motor terminal S	Resistance	Max. 1 Ω
			Wiring harness between R1 (female) (2), F2 (2), and ground	Resistance	Max. 1 Ω
			Wiring harness between RM4 (female) (5) and ground	Resistance	Max. 1 Ω
	11	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between M4 (female) (2), F2 (1), T-F1, or RM5 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (12), F3 (1), RM4 (3), or M10 (female) (2) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) and ground * Test F14 for only canopy specification.	Resistance	Min. 1 M Ω
			Between wiring harness between T-F4 and F20 (5) or between (9) and R1 (female) (4) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R1 (female) (3), F1 (3) and RM4 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between RM4 (female) (4) and M7 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between RM5 (female) (2) and starting motor terminal S and ground	Resistance	Min. 1 M Ω

Relative circuit diagram (PC27, 30, 35MR-2)



※ --- Only for CAB spec.
※1--- For PC35MR-2 with canopy spec, Serial No. 9242 and up for North America.

9JE00024

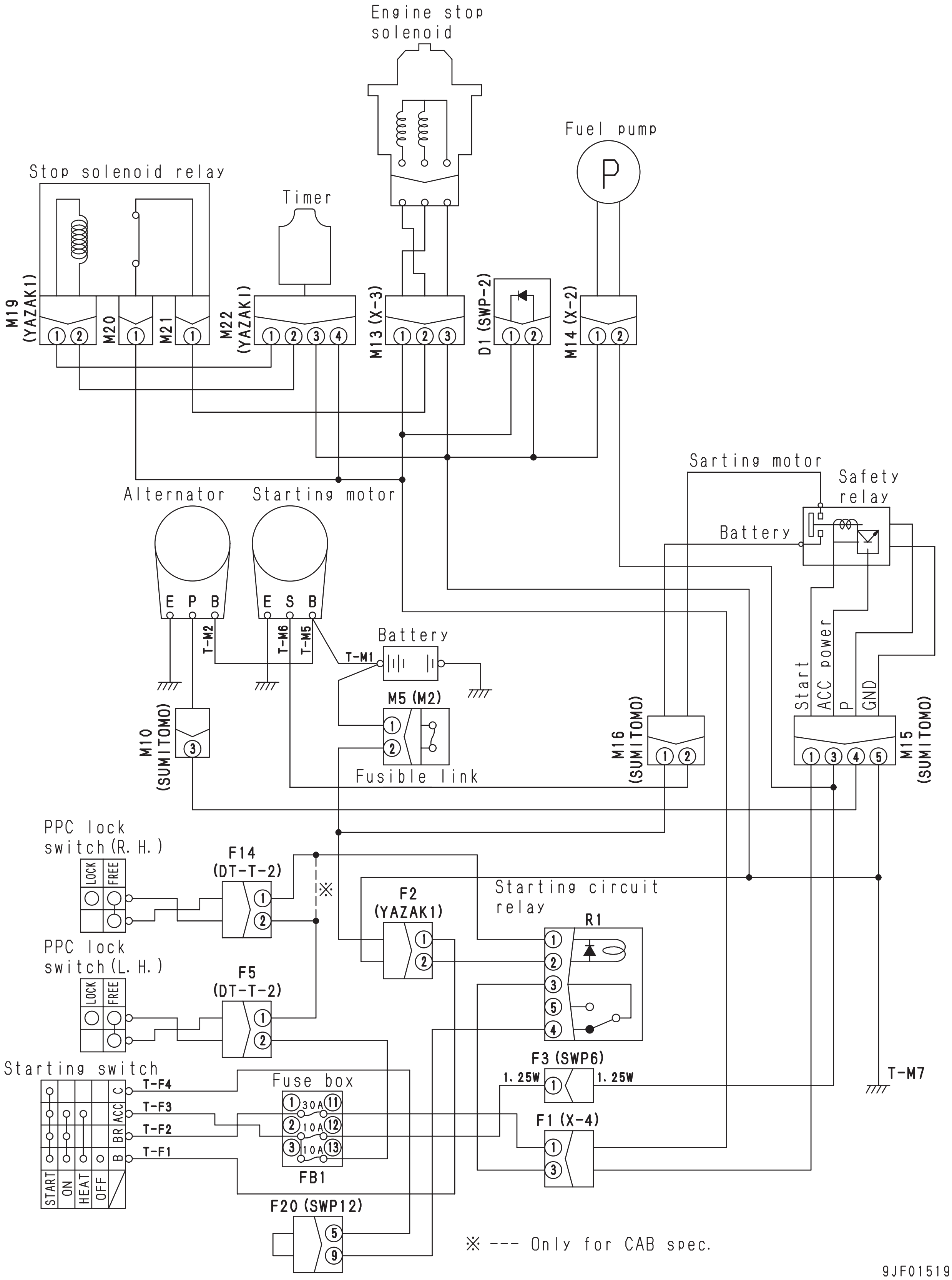
PC40, 50MR-2

Failure information	• Engine does not start (Starting motor does not rotated)
Relative information	• Since the engine starting circuit has a locking function, the engine cannot start if the PPC lock lever (safety lock lever) is not in the LOCK position. • The lock lever is installed to the right and left side of the canopy specification and to the left side of the cab specification.

<table>
<tr><td rowspan="31">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Insufficient battery capacity</td><td>Battery voltage</td><td colspan="2">Electrolyte specific gravity</td></tr>
<tr><td>Min. 12 V</td><td colspan="2">Min. 1.26</td></tr>
<tr><td>2</td><td>Defective 45-A fusible link or fuse (12) or (13)</td><td colspan="3">If the fusible link or fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Defective starting switch (Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td>Starting switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F4) terminal C</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>START</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F3) terminal ACC</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective PPC lock switch (left)
(Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F5.
3) Connect T-adapter to F5 (male).</td></tr>
<tr><td>F5 (male)</td><td>Lock lever position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>FREE</td><td>Max. 1 Ω</td></tr>
<tr><td>LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective PPC lock switch (right)
(Internal defective contact)
* Only canopy specification</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F14.
3) Connect T-adapter to F14 (male).</td></tr>
<tr><td>F14 (male)</td><td>Lock lever position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>FREE</td><td>Max. 1 Ω</td></tr>
<tr><td>LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="9">6</td><td rowspan="9">Defective starting motor cut-out relay
(Internal disconnection, defective contact, or fixing)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect relay R1.
3) Connect T-adapter to R1 (male).</td></tr>
<tr><td>R1 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (1) and (2)</td><td colspan="2">86 – 106 Ω</td></tr>
<tr><td>Between (3) and (4)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (3) and (5)</td><td colspan="2">Max. 1 M Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch OFF.
2) Insert T-adapter in relay R1.
3) Turn starting switch ON.</td></tr>
<tr><td>R1</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (4) and ground
(Set PPC lock lever in LOCK and starting switch in START)</td><td colspan="2">10 – 15 V</td></tr>
<tr><td colspan="3" style="display:none"></td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective starting motor</td><td colspan="3">1) Turn starting switch from OFF to START for troubleshooting.
(If power supply and starting input/output are normal and starting motor does not rotate, starting motor is defective.)</td></tr>
<tr><td>Starting motor</td><td>Starting switch</td><td>Voltage</td></tr>
<tr><td>Power supply: Between terminal B and ground</td><td>ON</td><td>10 – 15 V</td></tr>
<tr><td>Starting input: Between terminal S and ground</td><td>START</td><td>10 – 15 V</td></tr>
</table>

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	8	Defective safety relay (Internal defective contact or disconnection)	1) Turn starting switch from OFF to START for troubleshooting.		
			M16	Voltage	
			Between (2) and ground	10 – 15 V	
	9	Defective alternator (including regulator) (Internal short circuit)	1) Turn starting switch from OFF to ON or START for troubleshooting.		
			Alternator	Voltage	
			Between terminal P and ground	Max. 1 V	
	10	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Wiring harness between battery (+) and M5 (1) or between (2) and T-F1 or M16 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between T-F3 and fuse (2) or between (12) and F3 (1) and M15 (3)	Resistance	Max. 1 Ω
			Wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) * Check F14 for only canopy specification.	Resistance	Max. 1 Ω
			Wiring harness between T-F4 and F20 (5) or between (9) and R1 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between R1 (female) (3), F1 (3), and M15 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between M15 (female) (4) and M7 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between M16 (female) (2) and starting motor terminal S	Resistance	Max. 1 Ω
			Wiring harness between R1 (female) (2), F2 (2), and ground	Resistance	Max. 1 Ω
			Wiring harness between M15 (female) (5) and ground	Resistance	Max. 1 Ω
	11	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between M4 (female) (2), F2 (1), T-F1, or M16 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (12), F3 (1), M15 (3), or M10 (female) (2) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) and ground * Test F14 for only canopy specification.	Resistance	Min. 1 M Ω
			Between wiring harness between T-F4 and F20 (5) or between (9) and R1 (female) (4) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R1 (female) (3), F1 (3) and M15 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between M15 (female) (4) and M7 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between M16 (female) (2) and starting motor terminal S and ground	Resistance	Min. 1 M Ω

Relative circuit diagram (PC40, 50MR-2)



2) Engine does not start (Fault in engine stop solenoid)

PC27, 30, 35MR-2

★ For the related circuit diagram, see 1).

Failure information	• Engine does not start (Fault in engine stop solenoid)
Relative information	• The starting motor rotates but the engine does not start.

<table>
<tr><td rowspan="40">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (11)</td><td colspan="3">If the fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective starting switch
(Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td>Starting switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F4) terminal BR</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective engine stop solenoid
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M9.
3) Connect T-adapter to M9 (male).</td></tr>
<tr><td colspan="2">M9 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (3)</td><td>22 – 28 Ω</td></tr>
<tr><td colspan="2">Between (2) and (3)</td><td>0.63 – 0.77 Ω</td></tr>
<tr><td colspan="2">Between (1), (2), and body</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective timer
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>M3</td><td>Measurement condition</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>For 1 second after starting switch is turned ON</td><td>10 – 15 V</td></tr>
<tr><td>After 1 second</td><td>Max. 1 V</td></tr>
<tr><td rowspan="7">5</td><td rowspan="7">Defective engine stop solenoid relay
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector RM1.</td></tr>
<tr><td colspan="2">RM1 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>33 – 41 Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>RM3</td><td>Measurement condition</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (1) and ground</td><td>For 1 second after starting switch is turned ON</td><td>10 – 15 V</td></tr>
<tr><td>After 1 second</td><td>Max. 1 V</td></tr>
<tr><td rowspan="6">6</td><td rowspan="6">Disconnection in wiring harness
(Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect related connector.
3) Set PPC lock switch in LOCK.</td></tr>
<tr><td>Wiring harness between T-F2 and fuse (1), between (11), F1 (1) and M9 (female) (1) or M3 (female) (4) or RM2 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M9 (female) (2) and RM3 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M3 (female) (1) and RM1 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M3 (female) (2) and RM1 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M9 (female) (3) or M3 (female) (3) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Short circuit with chassis ground in wiring harness
(Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect related connector.
3) Set PPC lock switch in LOCK.</td></tr>
<tr><td>Between wiring harness between fuse (11), F1 (1) and M9 (female) (1) or M3 (female) (4) or RM2 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M9 (female) (2) and RM3 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M3 (female) (1) and RM1 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M3 (female) (2) and RM1 (female) (2) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

PC40, 50MR-2

★ For the related circuit diagram, see 1).

Failure information	• Engine does not start (Fault in engine stop solenoid)
Relative information	• The starting motor rotates but the engine does not start.

<table>
<tr><td rowspan="33">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (11)</td><td colspan="3">If the fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective starting switch
(Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td>Starting switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (T-F1) terminal B and (T-F4) terminal BR</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective engine stop solenoid
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M13.
3) Connect T-adapter to M13 (male).</td></tr>
<tr><td colspan="2">M13 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (3)</td><td>22 – 28 Ω</td></tr>
<tr><td colspan="2">Between (2) and (3)</td><td>0.29 – 0.37 Ω</td></tr>
<tr><td colspan="2">Between (1), (2), and body</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective timer
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>M22</td><td>Measurement condition</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>For 1 second after starting switch is turned ON</td><td>10 – 15 V</td></tr>
<tr><td>After 1 second</td><td>Max. 1 V</td></tr>
<tr><td rowspan="7">5</td><td rowspan="7">Defective engine stop solenoid relay
(Internal disconnection or short circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M19.</td></tr>
<tr><td colspan="2">M19 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>33 – 41 Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>M21</td><td>Measurement condition</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (1) and ground</td><td>For 1 second after starting switch is turned ON</td><td>10 – 15 V</td></tr>
<tr><td>After 1 second</td><td>Max. 1 V</td></tr>
<tr><td rowspan="6">6</td><td rowspan="6">Disconnection in wiring harness
(Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect related connector.
3) Set PPC lock switch in LOCK.</td></tr>
<tr><td>Wiring harness between T-F2 and fuse (1), between (11), F1 (1) and M13 (female) (1) or M22 (female) (4) or M20 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M13 (female) (2) and M21 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M22 (female) (1) and M19 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M22 (female) (2) and M19 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M13 (female) (3) or M22 (female) (3) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Short circuit with chassis ground in wiring harness
(Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect related connector.
3) Set PPC lock switch in LOCK.</td></tr>
<tr><td>Between wiring harness between fuse (11), F1 (1) and M13 (female) (1) or M22 (female) (4) or M20 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M13 (female) (2) and M21 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M22 (female) (1) and M19 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between M22 (female) (2) and M19 (female) (2) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

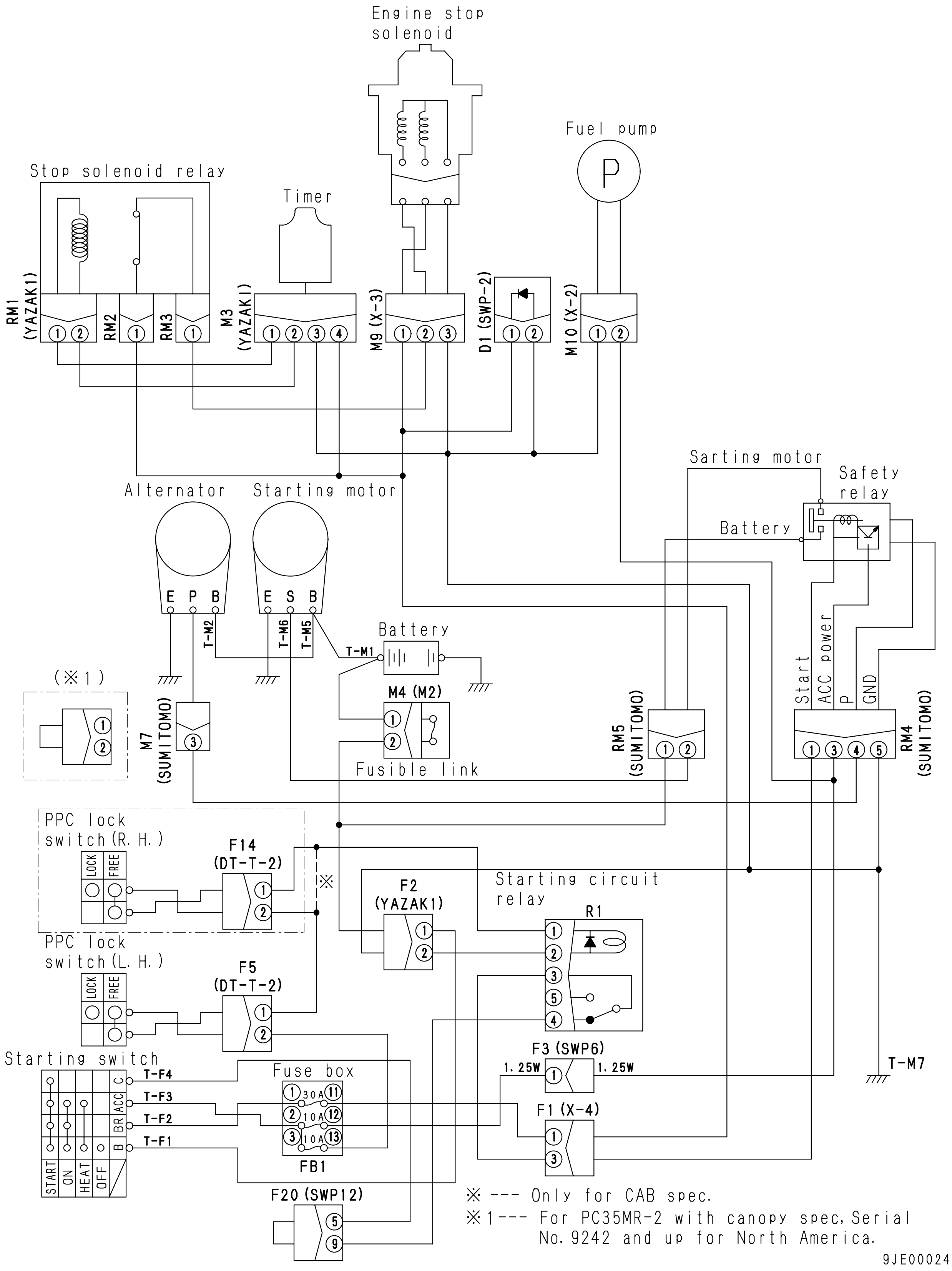
E-2 ENGINE DOES NOT STOP

PC27, 30, 35MR-2

Failure information	• Engine does not stop
Relative information	

<table>
<tr><td rowspan="11">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective engine stop solenoid (Internal defect)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M9.
3) Connect T-adapter to M9 (male).</td></tr>
<tr><td colspan="2">M9 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (3)</td><td>22 – 28 Ω</td></tr>
<tr><td colspan="2">Between (2) and (3)</td><td>0.63 – 0.77 Ω</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective starting switch (Internal short circuit)</td><td colspan="3">1) Turn starting switch from START to OFF for troubleshooting.</td></tr>
<tr><td>Starting switch</td><td>Position</td><td>Voltage</td></tr>
<tr><td>Between (T-F2) terminal BR and ground</td><td>OFF</td><td>Max. 1 V</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Short circuit with power source in wiring harness (Contact with 12V circuit)</td><td colspan="3">1) Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Between wiring harness between T-F2 and M9 (female) (1) and ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)

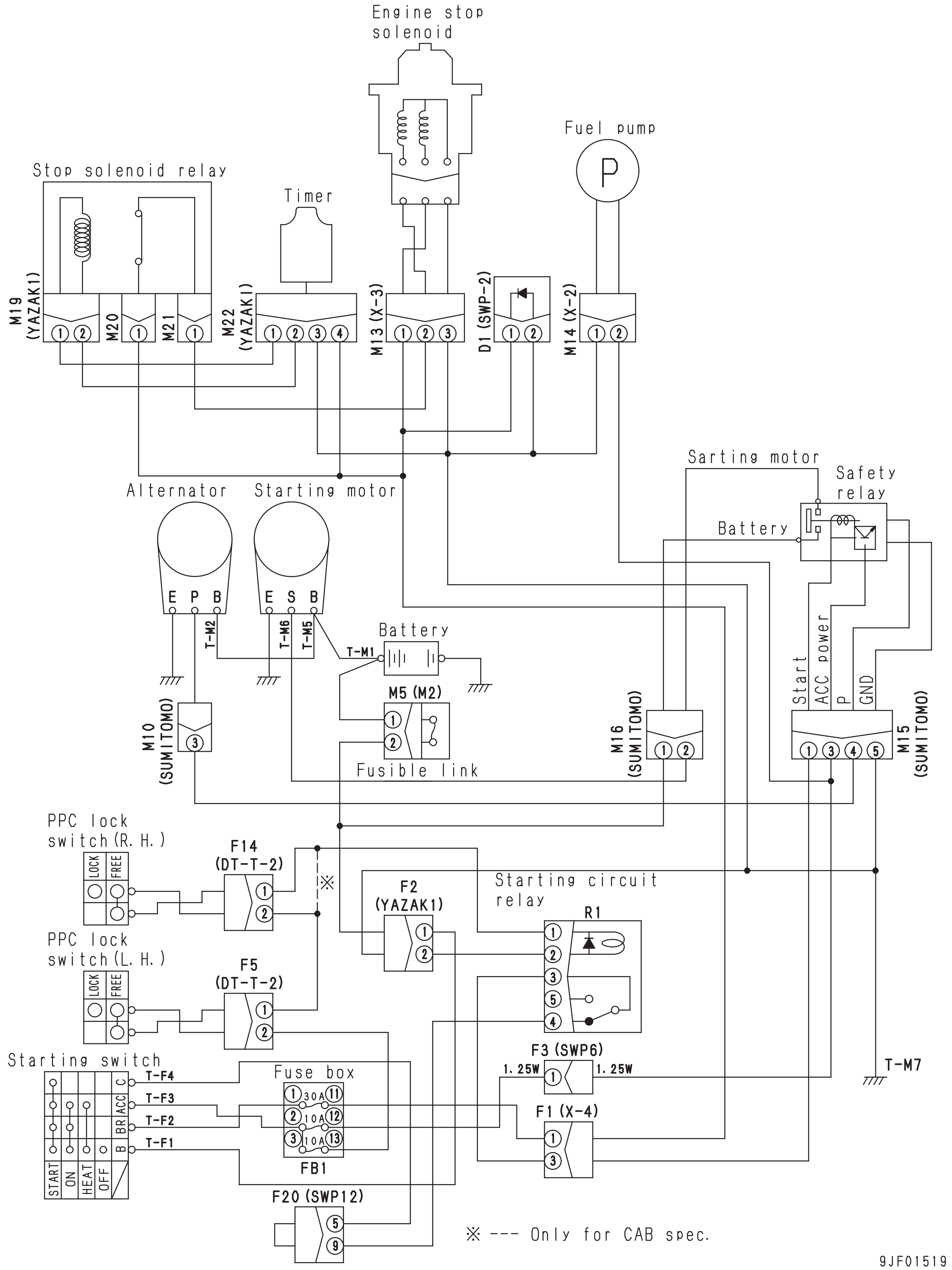


PC40, 50MR-2

Failure information	• Engine does not stop
Relative information	

<table>
<tr><td rowspan="8">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective engine stop solenoid (Internal defect)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connector M13.
3) Connect T-adapter to M13 (male).</td></tr>
<tr><td colspan="3">M13 (male)</td><td>Resistance</td></tr>
<tr><td colspan="3">Between (1) and (3)</td><td>22 – 28 Ω</td></tr>
<tr><td colspan="3">Between (2) and (3)</td><td>0.29 – 0.37 Ω</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective starting switch (Internal short circuit)</td><td colspan="4">1) Turn starting switch from START to OFF for troubleshooting.</td></tr>
<tr><td>Starting switch</td><td colspan="2">Position</td><td>Voltage</td></tr>
<tr><td>Between (T-F2) terminal BR and ground</td><td colspan="2">OFF</td><td>Max. 1 V</td></tr>
<tr><td></td><td rowspan="2">3</td><td rowspan="2">Short circuit with power source in wiring harness (Contact with 12V circuit)</td><td colspan="4">1) Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td></td><td colspan="2">Between wiring harness between T-F2 and M13 (female) (1) and ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
</table>

Relative circuit diagram (PC40, 50MR-2)



E-3 WHEN WORK EQUIPMENT LOCK (PPC BASIC PRESSURE LOCK) LEVER IS SET IN LOCK POSITION, WORK EQUIPMENT STILL MOVES

PC27, 30, 35MR-2

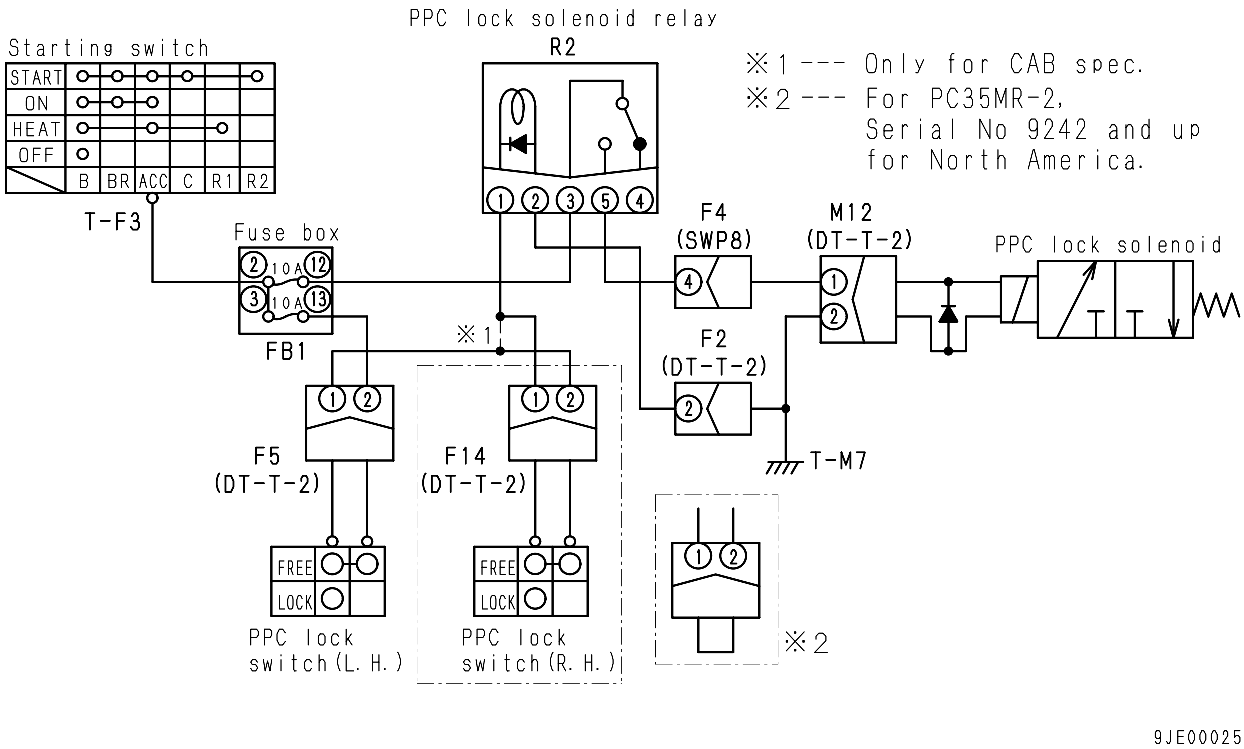
Failure information	• When work equipment lock (PPC basic pressure lock) lever is set in LOCK position, work equipment still moves
Relative information	

<table>
<tr><td rowspan="26">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="5">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (12) or (13)</td><td colspan="5">If either fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective starting switch
(Internal defective contact)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td colspan="2">Starting switch</td><td colspan="2">Position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (T-F1) terminal B and (T-F3) terminal ACC</td><td colspan="2">OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="2">ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective PPC lock switch (left)
(Internal defective contact)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector F5.
3) Connect T-adapter to F5 (male).</td></tr>
<tr><td colspan="2">F5 (male)</td><td colspan="2">Lock lever position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (1) and (2)</td><td colspan="2">FREE</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective PPC lock switch (right)
(Internal defective contact)
* Only canopy specification (*1)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector F14.
3) Connect T-adapter to F14 (male).</td></tr>
<tr><td colspan="2">F14 (male)</td><td colspan="2">Lock lever position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (1) and (2)</td><td colspan="2">FREE</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="9">5</td><td rowspan="9">Defective PPC lock relay
(Internal disconnection, defective contact, or fixing)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect relay R2.
3) Connect T-adapter to R2 (male).</td></tr>
<tr><td colspan="3">R2 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td colspan="2">86 – 106 Ω</td></tr>
<tr><td colspan="3">Between (3) and (4)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="3">Between (3) and (5)</td><td colspan="2">Min. 1 M Ω</td></tr>
<tr><td colspan="5">1) Turn starting switch OFF.
2) Insert T-adapter in relay R2.
3) Turn starting switch ON.</td></tr>
<tr><td colspan="2">R2</td><td colspan="2">Position of lock lever</td><td>Voltage</td></tr>
<tr><td colspan="2">Between (5) and ground</td><td colspan="2">LOCK</td><td>10 – 15 V</td></tr>
<tr><td colspan="5" style="display:none"></td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective PPC lock solenoid
(Internal disconnection or short circuit)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector M12.
3) Connect T-adapter to M12 (male).</td></tr>
<tr><td rowspan="2">M12
(male)</td><td>Between (1) and (2)</td><td>Resistance</td><td colspan="2">10.5 – 12 Ω</td></tr>
<tr><td>Between (1) and body</td><td>Resistance</td><td colspan="2">Min. 1 M Ω</td></tr>
</table>

(*1): Except PC35MR-2, Serial No. 9242 and up for North America.

			Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	7	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Wiring harness between T-F3, fuse (12) and R2 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between R2 (female) (5), F4 (4) and M12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between T-F3, fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R2 (female) (1) * Check F14 for only canopy specification.	Resistance	Max. 1 Ω
			Wiring harness between R2 (female) (2), F2 (2) and ground	Resistance	Max. 1 Ω
	8	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between fuse (12) and R2 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R2 (female) (5), F4 (4) and M12 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R2 (female) (1) and ground * Check F14 for only canopy specification.	Resistance	Min. 1 M Ω

Relative circuit diagram (PC27, 30, 35MR-2)



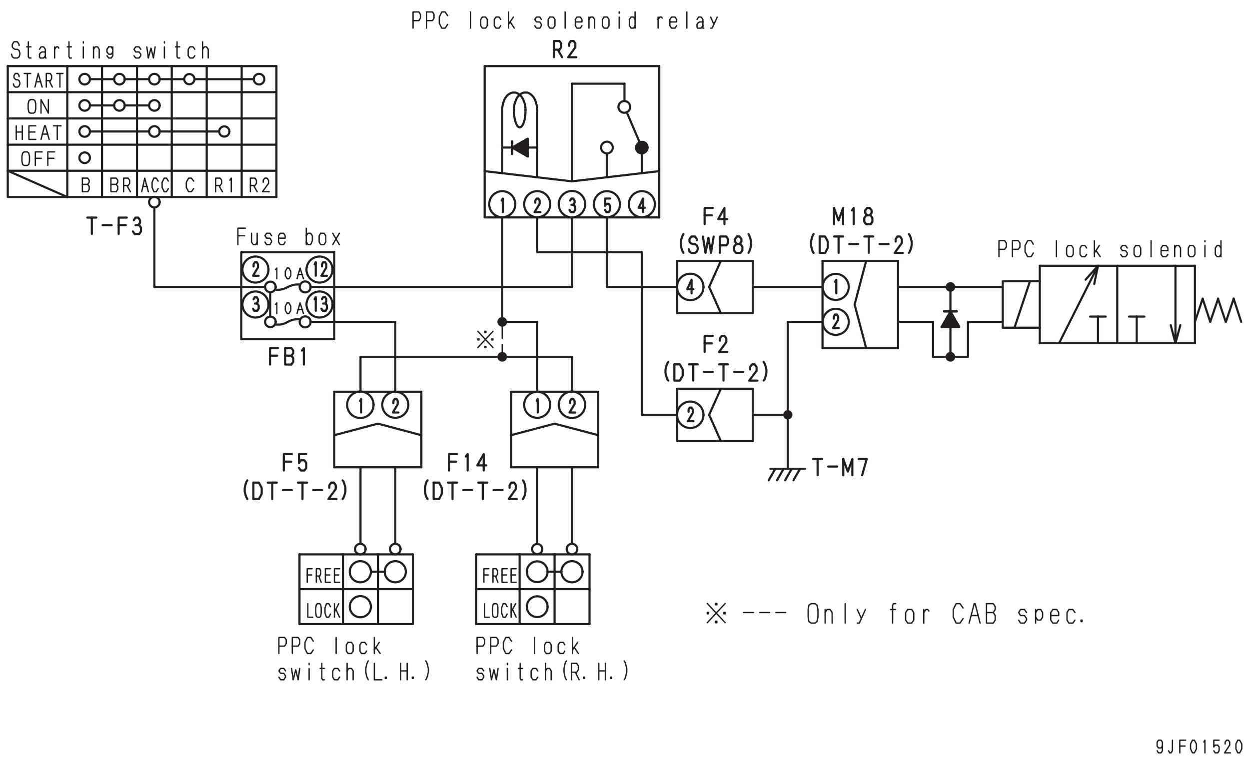
PC40, 50MR-2

Failure information	• When work equipment lock (PPC basic pressure lock) lever is set in LOCK position, work equipment still moves
Relative information	

<table>
<tr><td rowspan="25">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="5">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (12) or (13)</td><td colspan="5">If either fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective starting switch
(Internal defective contact)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td colspan="2">Starting switch</td><td colspan="2">Position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (T-F1) terminal B and (T-F3) terminal ACC</td><td colspan="2">OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="2">ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective PPC lock switch (left)
(Internal defective contact)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector F5.
3) Connect T-adapter to F5 (male).</td></tr>
<tr><td colspan="2">F5 (male)</td><td colspan="2">Lock lever position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (1) and (2)</td><td colspan="2">FREE</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective PPC lock switch (right)
(Internal defective contact)
* Only canopy specification</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector F14.
3) Connect T-adapter to F14 (male).</td></tr>
<tr><td colspan="2">F14 (male)</td><td colspan="2">Lock lever position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between (1) and (2)</td><td colspan="2">FREE</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">LOCK</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Defective PPC lock relay
(Internal disconnection, defective contact, or fixing)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect relay R2.
3) Connect T-adapter to R2 (male).</td></tr>
<tr><td colspan="3">R2 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td colspan="2">86 – 106 Ω</td></tr>
<tr><td colspan="3">Between (3) and (4)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="3">Between (3) and (5)</td><td colspan="2">Min. 1 M Ω</td></tr>
<tr><td colspan="5">1) Turn starting switch OFF.
2) Insert T-adapter in relay R2.
3) Turn starting switch ON.</td></tr>
<tr><td colspan="2">R2</td><td colspan="2">Position of lock lever</td><td>Voltage</td></tr>
<tr><td colspan="2">Between (5) and ground</td><td colspan="2">LOCK</td><td>10 – 15 V</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective PPC lock solenoid
(Internal disconnection or short circuit)</td><td colspan="5">1) Turn starting switch OFF.
2) Disconnect connector M18.
3) Connect T-adapter to M18 (male).</td></tr>
<tr><td rowspan="2">M18 (male)</td><td>Between (1) and (2)</td><td>Resistance</td><td colspan="2">10.5 – 12 Ω</td></tr>
<tr><td>Between (1) and body</td><td>Resistance</td><td colspan="2">Min. 1 M Ω</td></tr>
</table>

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	7	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Wiring harness between T-F3, fuse (12) and R2 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between R2 (female) (5), F4 (4) and M18 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between T-F3, fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R2 (female) (1) * Check F14 for only canopy specification.	Resistance	Max. 1 Ω
			Wiring harness between R2 (female) (2), F2 (2) and ground	Resistance	Max. 1 Ω
	8	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between fuse (12) and R2 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R2 (female) (5), F4 (4) and M18 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R2 (female) (1) and ground * Check F14 for only canopy specification.	Resistance	Min. 1 M Ω

Relative circuit diagram (PC40, 50MR-2)

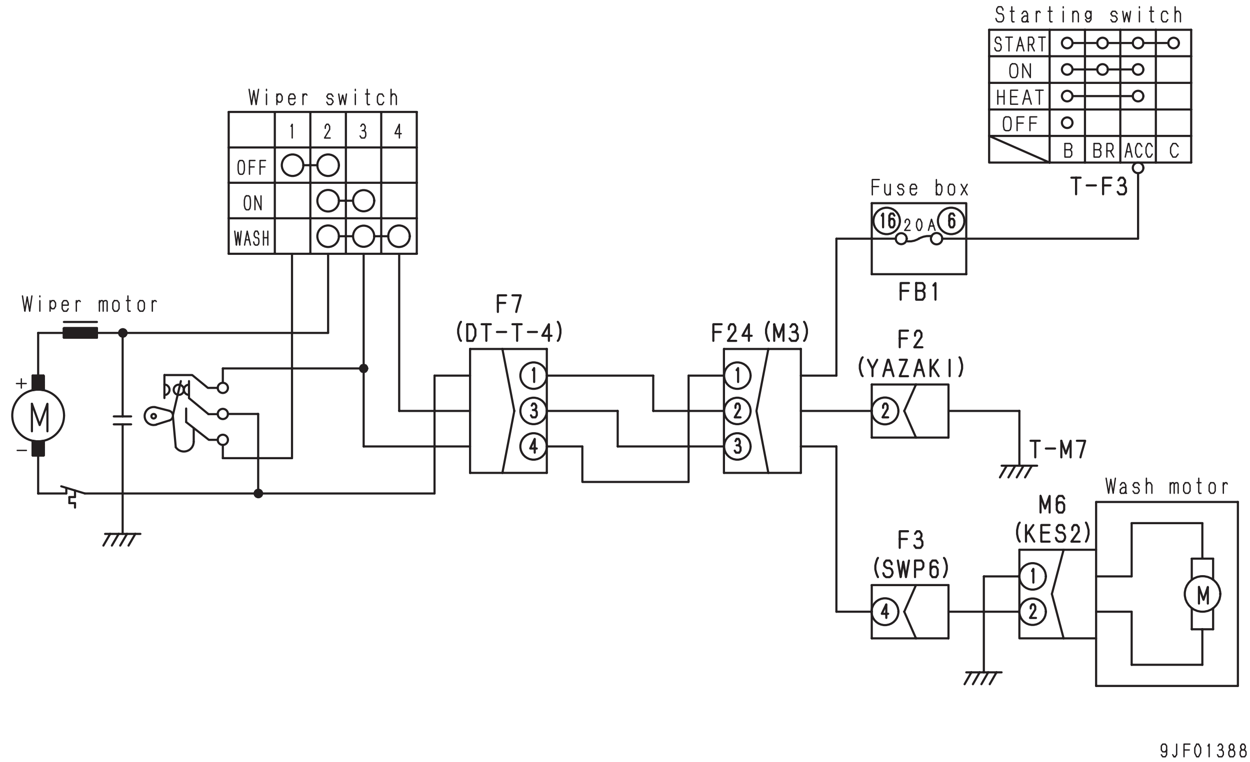


E-4 WINDSHIELD WIPER DOES NOT OPERATE

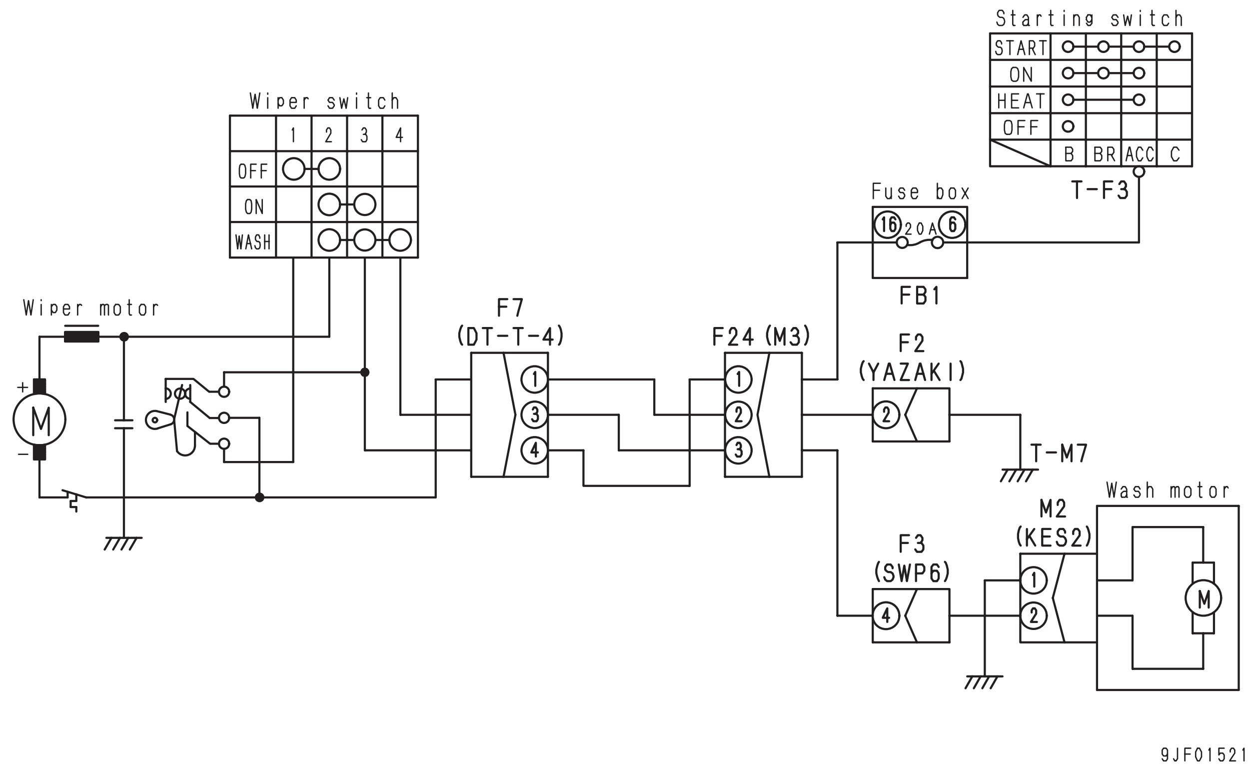
Failure information	• Windshield wiper does not operate
Relative information	• The engine can start. (If the engine cannot start, carry out troubleshooting E-1 first.)

<table>
<tr><td rowspan="21">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (16)</td><td colspan="4">If the fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="9">2</td><td rowspan="9">Defective wiper switch (Internal disconnection or defective contact)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connector wiper switch terminal.</td></tr>
<tr><td>Wiper switch</td><td colspan="2">Position</td><td>Resistance</td></tr>
<tr><td>Between terminals (1) and (2)</td><td colspan="2">OFF (Do not move)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between terminals (2) and (3)</td><td colspan="2">ON (1st position)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between terminals (2) and (3)</td><td colspan="2">WASH (2nd position)</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="4">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>Wiper switch</td><td colspan="2">Position</td><td>Voltage</td></tr>
<tr><td>Between terminal (2) and ground</td><td colspan="2">ON (1st position)</td><td>10 – 15 V</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect wiper switch terminal.</td></tr>
<tr><td colspan="2">Wiring harness between fuse (16), F24 (1), F7 (4) and wiper switch terminal (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between wiper switch terminal (2) and wiper motor (+) side</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between wiper motor (–) side, F7 (1), F24 (2), F2 (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect wiper switch terminal.</td></tr>
<tr><td colspan="2">Between wiring harness between fuse (16), F24 (1), F7 (4) and wiper switch terminal and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="2">Between wiring harness between wiper switch terminal (2) and wiper motor (+) side and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)



Relative circuit diagram (PC40, 50MR-2)



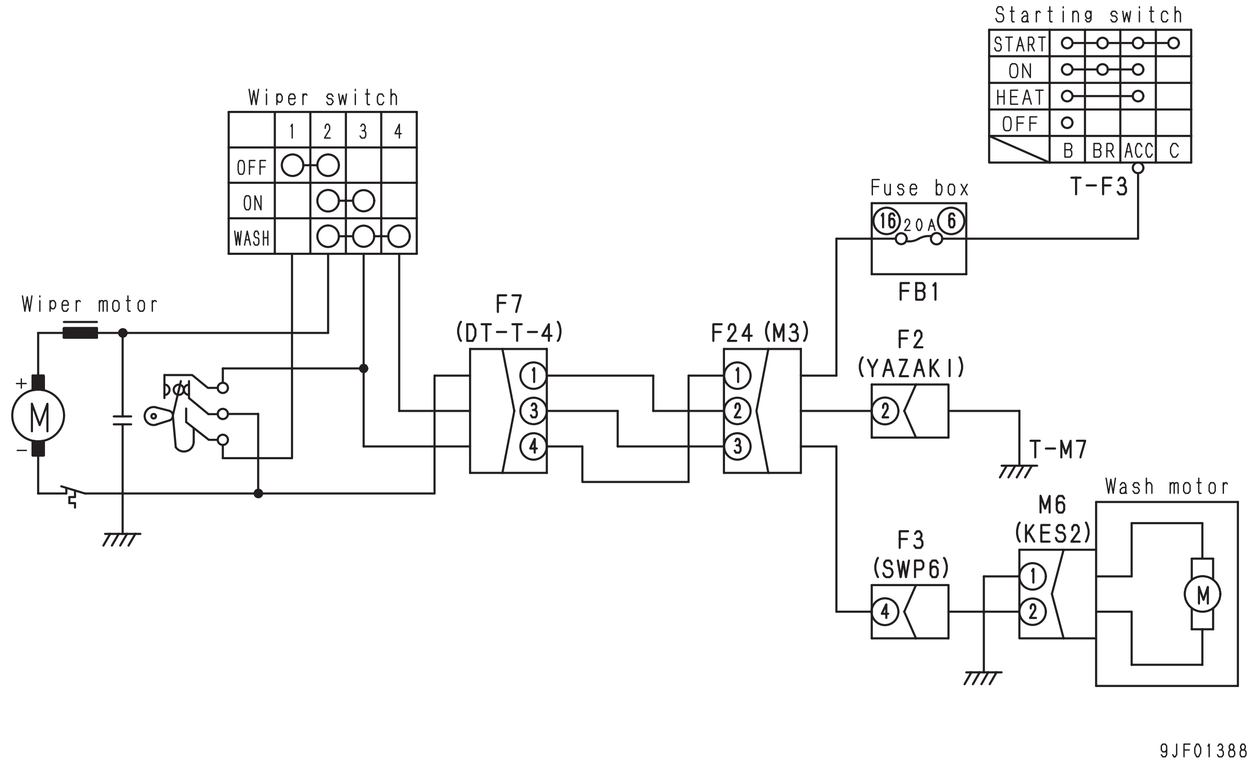
E-5 WINDSHIELD WASHER DOES NOT OPERATE

PC27, 30, 35MR-2

Failure information	• Windshield washer does not operate
Relative information	• Before starting troubleshooting, check the liquid level in the tank. • The windshield wiper operates. (If the windshield wiper does not operate, carry out troubleshooting E-4 first.)

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective washer motor (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect connector M6.		
			Between M6 (female) (1) and ground	Resistance	Min. 1 M Ω
			1) Turn starting switch OFF. 2) Connect T-adapter to M6 (female). 3) Turn starting switch ON.		
			Between M6 (female) (2) and ground	Voltage	10 – 15 V
	2	Defective wiper switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect wiper switch terminal.		
			Wiper switch	Position	Resistance
			Between terminals (3) and (4)	WASH (2nd position)	Max. 1 Ω
			1) Turn starting switch from OFF to ON for troubleshooting.		
			Wiper switch	Position	Voltage
			Between terminal (4) and ground	WASH (2nd position)	10 – 15 V
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector M6 and switch terminal. 3) Connect T-adapter to M6 (female).		
			Wiring harness between M6 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4)	Resistance	Max. 1 Ω
			Wiring harness between M6 (female) (1) and ground	Resistance	Max. 1 Ω
	4	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connector M6 and switch terminal 3) Connect T-adapter to M6 (female).		
			Between wiring harness between M6 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4) and ground	Resistance	Min. 1 M Ω

Relative circuit diagram (PC27, 30, 35MR-2)

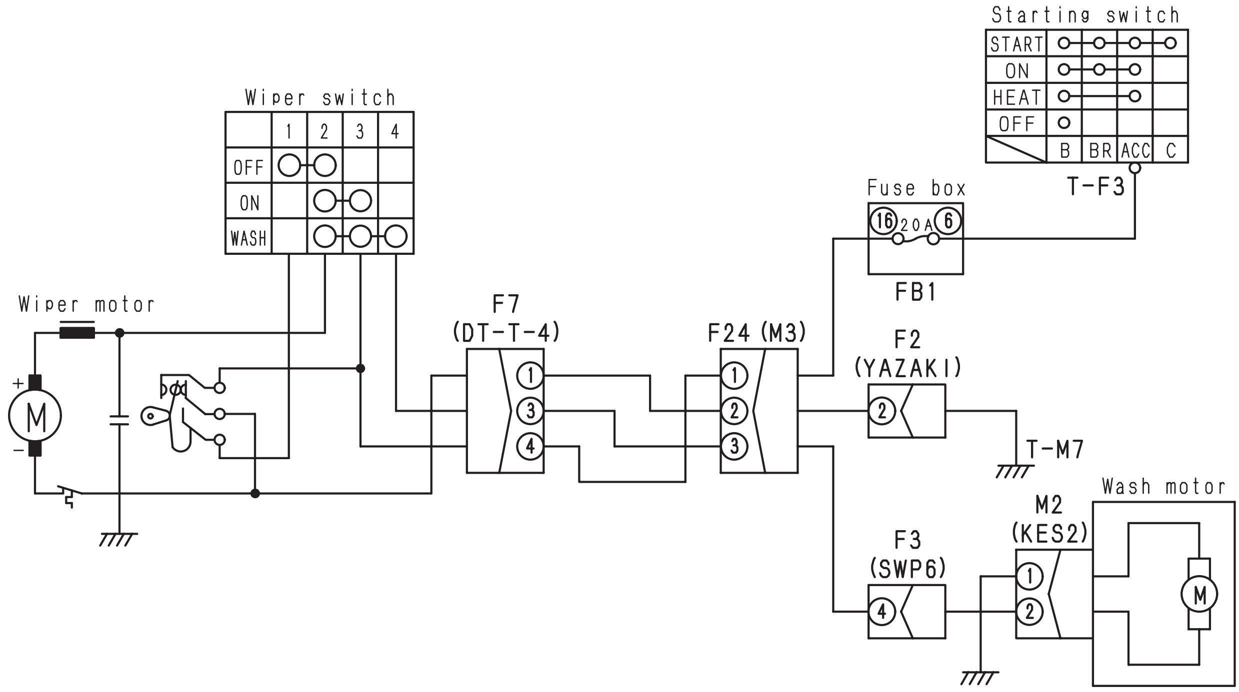


PC40, 50MR-2

Failure information	• Windshield washer does not operate
Relative information	• Before starting troubleshooting, check the liquid level in the tank. • The windshield wiper operates. (If the windshield wiper does not operate, carry out troubleshooting E-4 first.)

<table>
<tr><td rowspan="21">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective washer motor (Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M2.</td></tr>
<tr><td>Between M2 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch OFF.
2) Connect T-adapter to M2 (female).
3) Turn starting switch ON.</td></tr>
<tr><td>Between M2 (female) (2) and ground</td><td>Voltage</td><td>10 – 15 V</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective wiper switch (Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect wiper switch terminal.</td></tr>
<tr><td>Wiper switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td>Between terminals (3) and (4)</td><td>WASH (2nd position)</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch from OFF to ON for troubleshooting.</td></tr>
<tr><td>Wiper switch</td><td>Position</td><td>Voltage</td></tr>
<tr><td>Between terminal (4) and ground</td><td>WASH (2nd position)</td><td>10 – 15 V</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M2 and switch terminal.
3) Connect T-adapter to M2 (female).</td></tr>
<tr><td>Wiring harness between M2 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M2 (female) (1) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M2 and switch terminal
3) Connect T-adapter to M2 (female).</td></tr>
<tr><td>Between wiring harness between M2 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

Relative circuit diagram (PC40, 50MR-2)



9JF01521

E-6 TRAVEL ALARM DOES NOT SOUND

Applicable model: PC30MR-2

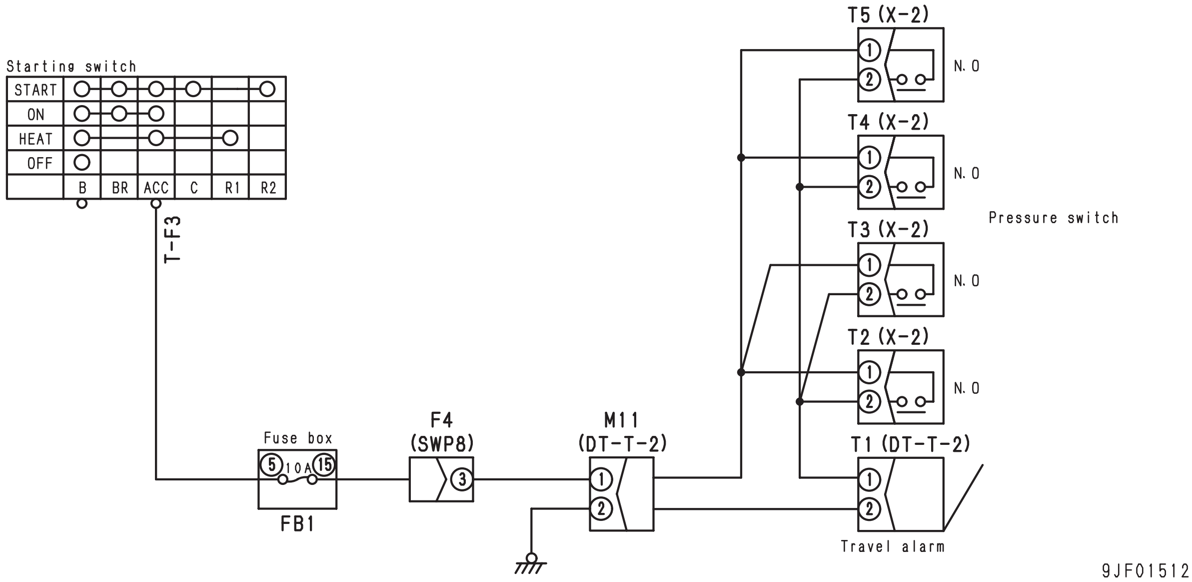
Failure information	• Travel alarm does not sound
Relative information	

<table>
<tr><td rowspan="20">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (15)</td><td colspan="3">If the fuse is broken, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="7">2</td><td rowspan="7">Defective travel alarm</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector T1.
3) Connect T-adapter to female side of T1.
4) Start engine.
⚠ Operate the travel lever a little to a degree that the machine does not move.</td></tr>
<tr><td>T1 (female)</td><td>Travel lever</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (1) and ground</td><td>Set all levers in neutral</td><td>Max. 1 V</td></tr>
<tr><td>Operate lever</td><td>10 – 15 V</td></tr>
<tr><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector T1.
3) Connect T-adapter to female side of T1.</td></tr>
<tr><td>Between T1 (female) (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective pressure switch (Internal defective contact)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors T2, T3, T4, and T5 one by one before measuring them.
3) Connect T-adapter to male side of disconnected connector.
4) Start engine.
⚠ Operate the travel lever a little to a degree that the machine does not move.</td></tr>
<tr><td>T2, T3, T4, T5 (male)</td><td>Travel lever</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>Set lever in neutral</td><td>Min. 1 M Ω</td></tr>
<tr><td>Operate lever</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors T1, T2, T3, T4, and T5.
3) Connect T-adapter to female side of connector to be measured.</td></tr>
<tr><td>Wiring harness between fuse (15), F4 (3), M11 (1), T2 (female) (1), T3 (female) (1), T4 (female) (1) and T5 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between T1 (female) (1), T2 (female) (2), T3 (female) (2), T4 (female) (2) and T5 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between T1 (female) (2), M11 (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors T1, T2, T3, T4, and T5.
3) Connect T-adapter to female side of connector to be measured.</td></tr>
<tr><td>Between wiring harness between fuse (15), F4 (3), M11 (1), T2 (female) (1), T3 (female) (1), T4 (female) (1) and T5 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between wiring harness between T1 (female) (1), T2 (female) (2), T3 (female) (2), T4 (female) (2) and T5 (female) (2) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

Combination table of pressure switches and travel levers

Pressure switch (Connector No.)	Operating direction of travel lever
T2	Right forward
T3	Left forward
T4	Right reverse
T5	Left reverse

Relative circuit diagram

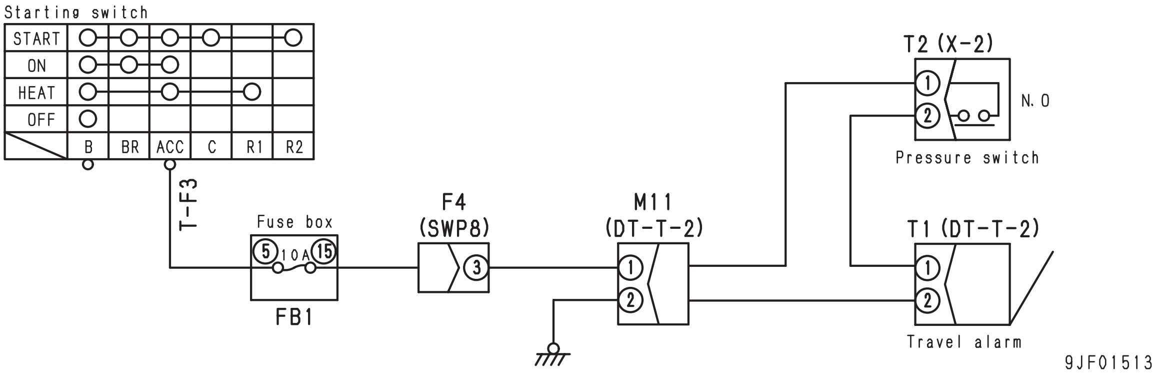


Applicable model: PC35MR-2

Failure information	• Travel alarm does not sound
Relative information	

	No.	Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fuse (15)	If the fuse is broken, the circuit probably has a grounding fault.		
	2	Defective travel alarm	1) Turn starting switch OFF. 2) Disconnect connector T1. 3) Connect T-adapter to female side of T1. 4) Start engine. Operate the travel lever a little to a degree that the machine does not move.		
			T1 (female)	Travel lever	Voltage
			Between (1) and ground	Set all levers in neutral	Max. 1 V
				Operate lever	10 – 15 V
			1) Turn starting switch OFF. 2) Disconnect connector T1. 3) Connect T-adapter to female side of T1.		
			Between T1 (female) (2) and ground	Resistance	Max. 1 Ω
	3	Defective pressure switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect connector T2. 3) Connect T-adapter to male side of T2. 4) Start engine. Operate the travel lever a little to a degree that the machine does not move.		
			T2 (male)	Travel lever	Resistance
			Between (1) and (2)	Set lever in neutral	Min. 1 M Ω
				Operate lever	Max. 1 Ω
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors T1, T2. 3) Connect T-adapter to female side of T1, T2.		
			Wiring harness between fuse (15), F4 (3), M11 (1), T2 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between T1 (female) (1), T2 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between T1 (female) (2), M11 (2), and ground	Resistance	Max. 1 Ω
	5	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors T1, T2. 3) Connect T-adapter to female side of T1, T2.		
			Between wiring harness between fuse (15), F4 (3), M11 (1), T2 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between T1 (female) (1), T2 (female) (2) and ground	Resistance	Min. 1 M Ω

Relative circuit diagram



E-7 DEFECTIVE AIR CONDITIONER

1) Air conditioner does not operate

<table>
<tr><td>Trouble</td><td>• Air conditioner does not operate</td></tr>
<tr><td>Related information</td><td>• Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.
• When the blower switch is turned ON (in the 1, 2, or 3 position), the air conditioner switch is turned ON.
• If air does not blow out, carry out troubleshooting for "2) Air does not blow out or air flow rate does not change" first.</td></tr>
</table>

<table>
<tr><td rowspan="13">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective air conditioner switch</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td>Air conditioner switch connector</td><td>Operation of switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">C – D</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 M Ω</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the continuity between connectors.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Defective control amplifier</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Replace control amplifier with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Control amplifier is defective.</td></tr>
<tr><td>Condition does not become normal.</td><td colspan="2">Control amplifier is normal.</td></tr>
</table>

2) Air does not blow out or air flow rate does not change

Trouble	• Air does not blow out or air flow rate does not change
Related information	• Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

<table>
<tr><td rowspan="25">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="9">1</td><td rowspan="9">Defective blower switch</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td>Position of knob</td><td colspan="2">Blower switch terminal</td><td>Resistance</td></tr>
<tr><td>0</td><td colspan="2">Between all terminals</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">1</td><td colspan="2">Between B and L/R, between B and L/W, and between L/R and L/W</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between terminals other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">2</td><td colspan="2">Between B and L/R, between B and L/Y, and between L/R and L/Y</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between terminals other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">3</td><td colspan="2">Between B and L/R, between B and L/B, and between L/R and L/B</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between terminals other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective resistor</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Resistor terminals</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between L and M1</td><td colspan="2">Approx. 1.8 Ω</td></tr>
<tr><td colspan="2">Between M1 and M2</td><td colspan="2">Approx. 0.7 Ω</td></tr>
<tr><td colspan="2">Between M2 and M0</td><td colspan="2">Approx. 0.3 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective blower motor</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Replace blower motor with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Blower motor is defective.</td></tr>
<tr><td>Condition does not become normal.</td><td colspan="2">Blower motor is normal.</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the continuity between connectors.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective control amplifier</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Replace control amplifier with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Condition does not become normal.</td></tr>
<tr><td>Control amplifier is defective.</td><td colspan="2">Control amplifier is normal.</td></tr>
</table>

3) Blowing air temperature cannot be adjusted

Trouble	• Blowing air temperature cannot be adjusted
Related information	• Check in advance that hot water is supplied to the inlet side of the water valve. • Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

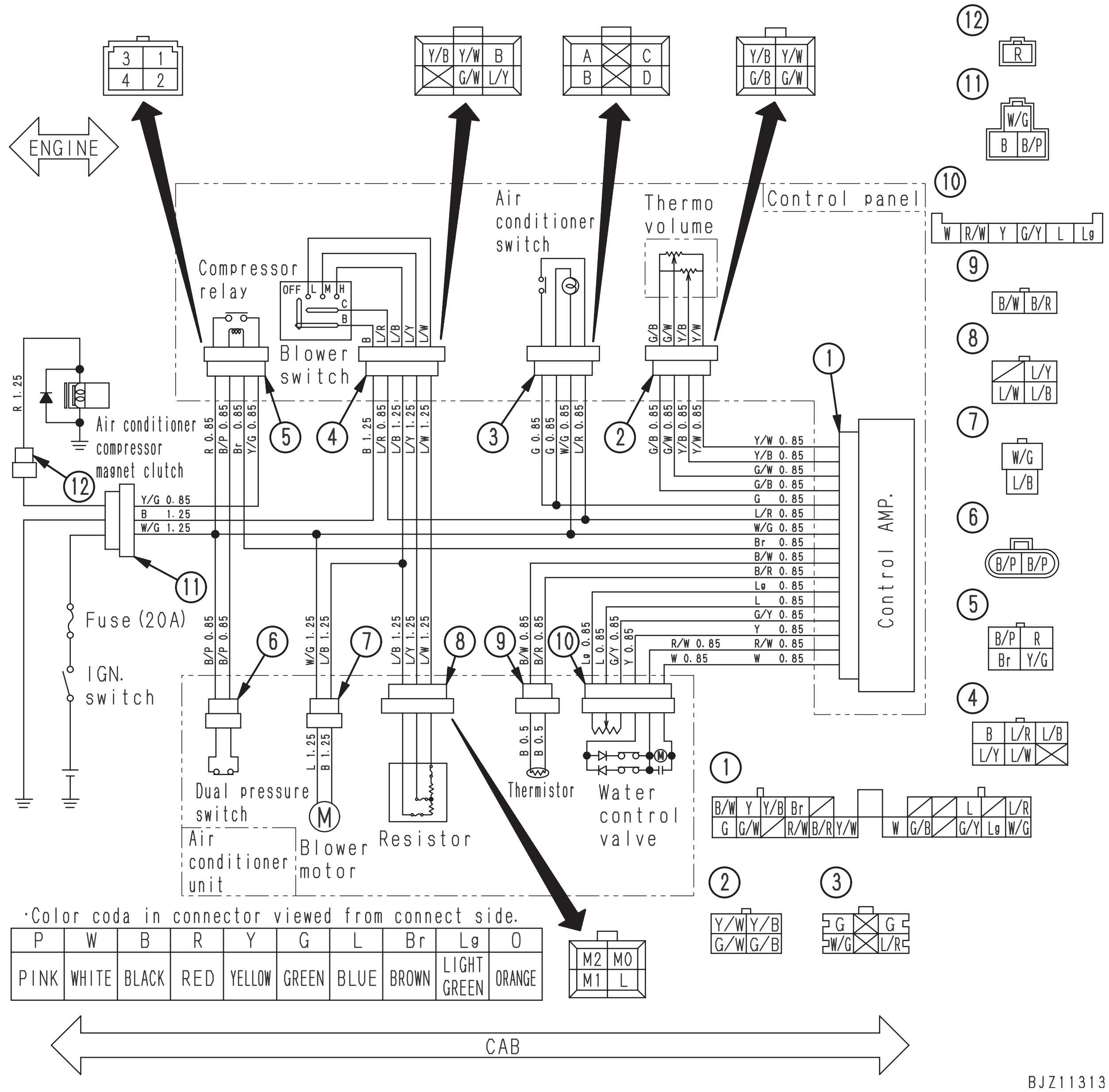
<table>
<tr><td rowspan="24">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="11">1</td><td rowspan="11">Defective temperature regulator switch</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.
★ Turn blower switch ON (Set it to the 1, 2, or 3 position) and carry out troubleshooting.</td></tr>
<tr><td colspan="3">Temperature regulator switch connector (2)</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="3">G/B – G/W</td><td colspan="2">Changes between 0 and approx. 5 V.</td></tr>
<tr><td colspan="3">G/B – Y/B</td><td colspan="2">Changes between 0 and approx. 5 V.</td></tr>
<tr><td colspan="3">G/B – Y/W</td><td colspan="2">Approx. 5 V</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Temperature regulator switch connector (2) (Switch side)</td><td>Operation of knob</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Y/W – Y/B</td><td>COOL-MAX → Middle position</td><td colspan="2">Approx. 2.3 kΩ → Max. 1 Ω</td></tr>
<tr><td>Middle position → HOT-MAX</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="2" rowspan="2">Y/W G/W</td><td>COOL-MAX → Middle position</td><td colspan="2">Approx. 2.3 kΩ</td></tr>
<tr><td>Middle position → HOT-MAX</td><td colspan="2">Approx. 2.3 kΩ → Max. 1 Ω</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective water valve</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.
★ Turn blower switch ON (Set it to the 1, 2, or 3 position) and carry out troubleshooting.</td></tr>
<tr><td>Operation</td><td colspan="4">Rod operates according to operation of temperature regulator switch.</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2" rowspan="2">Replace water valve assembly with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Water valve assembly is defective.</td></tr>
<tr><td>Condition does not become normal.</td><td colspan="2">Water valve assembly is normal.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="3">Referring to the circuit diagram, check the continuity between connectors.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="3">Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)</td><td>Resistance</td><td>Min. 1M Ω</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Defective control amplifier</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2" rowspan="2">Replace control amplifier with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Control amplifier is defective.</td></tr>
<tr><td>Condition does not become normal.</td><td colspan="2">Control amplifier is normal.</td></tr>
</table>

4) Blowing air is not cooled or temperature cannot be adjusted (Electrical system)

Trouble	• Blowing air is not cooled or temperature cannot be adjusted (Electrical system)
Related information	• When the ambient temperature is below 2 °C, this phenomenon is not a trouble. • Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

<table>
<tr><td rowspan="28">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective compressor clutch</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Between (12) and chassis ground</td><td>Voltage</td><td>10 – 15 V</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Defective dual pressure switch</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Dual pressure switch connector</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective air conditioner switch</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td>Air conditioner switch connector</td><td>Operation of switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">C – D</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1M Ω</td></tr>
<tr><td rowspan="7">4</td><td rowspan="7">Defective compressor relay</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Compressor relay connector</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">(1) – (2)</td><td colspan="2">Approx. 320 Ω</td></tr>
<tr><td>Compressor relay connector</td><td>Source voltage between (1) and (2)</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">(3) – (4)</td><td>When applied</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>When not applied</td><td colspan="2">Min. 1M Ω</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Defective thermistor</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td>Thermistor connector</td><td>Inspection temperature</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">B/W – B/R</td><td>0 °C</td><td colspan="2">Approx. 7.2 Ω</td></tr>
<tr><td>25 °C</td><td colspan="2">Approx. 2.2 Ω</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the continuity between connectors.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.</td></tr>
<tr><td colspan="2">Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)</td><td>Resistance</td><td>Min. 1M Ω</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Defective control amplifier</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Replace control amplifier with normal one.</td><td>Condition becomes normal.</td><td colspan="2">Control amplifier is defective.</td></tr>
<tr><td>Condition does not become normal.</td><td colspan="2">Control amplifier is normal.</td></tr>
</table>

Relative circuit diagram



5) Defective cooling (Mechanical system)

Trouble	• Defective cooling (Mechanical system)
Related information	—

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Gas leakage from pipe joint or piping part	Check. If abnormality is detected, repair or replace.
	2	Natural leakage from hoses, etc. (Refrigerant has not been added for long period)	Check quantity of refrigerant. If insufficient, add proper amount of refrigerant.
	3	Insufficient charge with refrigerant	Charge with refrigerant to proper level.
	4	Defective expansion valve	Check. If abnormality is detected, repair or replace. ★ Check that the valve is not opened too wide. Check thermometer tube for defective contact.
	5	Clogging of low-pressure circuit or evaporator	Check. If any part is clogged, repair or replace.
	6	Clogging of evaporator fins	Check. If evaporator fins are clogged, clean them.
	7	Clogging of filter	Check, then clean or replace.
	8	Defective installation of thermistor	Check. If abnormality is detected, repair or replace.
	9	Air leakage from air conditioner unit or duct joint	Check. If leakage is detected, repair or replace.
	10	Insufficient set air flow	Increase the set air flow.
	11	Overcharging with refrigerant	Check quantity of refrigerant. If it is too much, reduce it to proper level.
	12	Air in system	Evacuate the system, then charge it with proper quantity of refrigerant and replace receiver drier.
	13	Clogging of condenser fins	Check. If condenser fins are clogged, clean them.
	14	Defective compression by compressor	Check. If abnormality is detected, repair or replace.
	15	Water in refrigerant circuit	Evacuate the system, then charge it with proper quantity of refrigerant and replace receiver drier.

6) Defective heating (Defective hot-water circuit)

Trouble	• Defective heating (Defective hot-water circuit)
Related information	• Check that water is not leaking from the hot-water circuit • Check that air is blowing out of the air outlet.

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Clogging of heater core fins	Check. If heater core fins are clogged, clean them. ★ If this item is the cause, both temperatures at the heater core hot-water inlet and outlet are high.
	2	Air leakage from air conditioner unit	Check. If leakage is detected, repair or replace. ★ If this item is the cause, both temperatures at the heater core hot-water inlet and outlet are high.
	3	Defective waste valve (Clogging or defect in valve)	Check. If clogging or defect is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is high and that at the heater core hot-water outlet is low.
	4	Clogging in heater core	Check. If clogging is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is high and that at the heater core hot-water outlet is low.
	5	Clogging up to heater core hot-water inlet	Check. If clogging is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is low.

7) Abnormal sound comes out

Trouble	• Abnormal sound comes out.
Related information	

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective installation of case bolts (screws)	Check. If abnormality is detected, repair.
	2	Interference of fan case or breakage of fan	Check. If abnormality is detected, repair or replace.
	3	Foreign matter in blower motor or defective blower motor	Check. If abnormality is detected, remove foreign matter and repair or replace.
	4	Defective expansion valve	Check. If abnormal sound (blowing or leaking sound) comes out, replace valve.
	5	Looseness or wear of compressor V-belt	Check. If looseness or wear is detected, repair or replace.
	6	Improper quantity of refrigerant	Check quantity of refrigerant, then adjust it properly, if necessary.
	7	Defective compressor	Check. If abnormality is detected, repair or replace.

8) Water leaks

Trouble	• Water leaks.
Related information	—

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Clogging of water drain opening in air conditioner unit	Check. If abnormality is detected, repair.
	2	Clogging, bend, defective installation, or hole of drain hose of air conditioner unit	Check. If abnormality is detected, repair or replace.
	3	Breakage (Cracking) of air conditioner unit case	Check. If breakage (cracking) is detected, repair or replace.
	4	Defective mounting bolt (screw) of air conditioner unit case	Check. If abnormality is detected, repair or replace.
	5	Defective joint of hot-water circuit piping	Check. If abnormality is detected, repair or replace.
	6	Defective heater core	Check. If abnormality is detected, repair or replace.
	7	Defective water valve	Check. If abnormality is detected, repair or replace.

9) External and internal air cannot be changed

Trouble	• External and internal air cannot be changed
Related information	—

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Malfunction of EXTERNAL/INTERNAL air changeover lever	Check. If abnormality is detected, clean, repair, or replace.
	2	Malfunction intake damper	Check. If abnormality is detected, clean, repair, or replace.
	3	Clogging of external air intake duct of unit	Check. If abnormality is detected, clean.

TROUBLESHOOTING OF HYDRAULIC AND MECHANICAL SYSTEM (H-MODE)

IINFORMATION CONTAINED IN TROUBLESHOOTING TABLE 20-402
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H-2 ENGINE SPEED LOWERS EXTREMELY OR ENGINE STALLS 20-407
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INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ Troubleshooting Table collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

Failure information	Phenomena occurring on machine
Relative information	Information on occurred failures and troubleshooting

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td rowspan="5">Cause for presumed failure
(The attached No. for filing and reference purpose only. It does not stand for any priority)</td><td rowspan="5"><Contents>
• The standard values in normalcy by which to judge "good" or "no good" about presumed causes.
• References for making judgement of "good" or "no good"</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
</table>

H-1 SPEED OR POWER OF WHOLE WORK EQUIPMENT, TRAVEL, SWING, AND BLADE IS LOW

★ Check the combination of the systems which are low in speed or power according to the following table, then go to the specified troubleshooting item.

○: Normal
×: Low in speed or power

Whole work equipment	Travel	Swing	Blade	Trouble-shooting item
×	×	×	×	Go to 1)
×	×	○	○	Go to 2)
○	○	×	×	Go to 3)
×	○	○	×	Go to 4)
○	×	○	×	Go to 5)
×	○	○	○	Go to 6)

1) Speed or power of whole work equipment, travel, swing, and blade is low

Failure information	• Speed or power of whole work equipment, travel, swing, and blade is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Before starting troubleshooting, check that the electric system (solenoid circuit) is normal. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="16">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of PPC basic pressure lock solenoid valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Position of work equipment lock lever</td><td colspan="2">Solenoid valve output pressure</td></tr>
<tr><td>LOCK</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">FREE</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective adjustment or malfunction of control circuit relief valve
(PC35, 40, 50MR-2)</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td colspan="2">Control circuit relief pressure</td></tr>
<tr><td rowspan="2">Set all levers in neutral</td><td>PC35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If the oil pressure does not become normal after adjustment, the control relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Malfunction of self-reducing pressure valve (PC27, 30MR-2)</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td colspan="2">Control circuit oil pressure</td></tr>
<tr><td>Set all levers in neutral</td><td colspan="2">$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>4</td><td>Clogging of suction strainer</td><td colspan="3">If the results of 1 – 3 are normal, the strainer may be clogged. Check it directly.</td></tr>
<tr><td>5</td><td>Defective control pump (PC35, 40, 50MR-2)</td><td colspan="3">If the results of 1, 2, and 4 are normal, the control pump may be defective.</td></tr>
</table>

2) Speed or power of whole work equipment and travel is low

Failure information	• Speed or power of whole work equipment and travel is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="23">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Defective adjustment or malfunction of main relief valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control levers</td><td colspan="2">Main relief pressure</td></tr>
<tr><td colspan="2" rowspan="3">• Move arm IN to relieve its circuit.
• Drive machine to relieve travel circuit.</td><td>PC27MR-2</td><td>2.45 $^{+0.98}_{-0.49}$ MPa
{250 $^{+10}_{-5}$ kg/cm^2}</td></tr>
<tr><td>PC30, 35MR-2</td><td>26 $^{+0.98}_{-0.49}$ MPa
{265 $^{+10}_{-5}$ kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa
{270±10kg/cm^2}</td></tr>
<tr><td colspan="4">If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of unload valve
* PC35, 40, 50MR-2 has 2 sets of this valve.</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control levers</td><td colspan="2">Unload pressure</td></tr>
<tr><td colspan="2" rowspan="3">Set all levers in neutral</td><td>PC27, 30MR-2</td><td>3.9 $^{+0.98}_{0}$ MPa
{39.6 $^{+10}_{0}$ kg/cm^2}</td></tr>
<tr><td>PC35MR-2</td><td>3.2 $^{+0.98}_{0}$ MPa
{33 $^{+10}_{0}$ kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa
{33±5kg/cm^2}</td></tr>
<tr><td rowspan="7">3</td><td rowspan="7">Defective adjustment or malfunction of LS valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2" rowspan="2">Oil pressure to be measured</td><td colspan="2">Differential pressure</td></tr>
<tr><td>Set all levers in neutral</td><td>Curl bucket with no load (Move lever to stroke end)</td></tr>
<tr><td rowspan="3">Difference pressure between pump discharge pressure and LS valve input pressure</td><td>PC27, 30MR-2</td><td>3.9 $^{+0.98}_{0}$ MPa
{39.6 $^{+10}_{0}$ kg/cm^2}</td><td>1.57±0.1MPa
{16±1kg/cm^2}</td></tr>
<tr><td>PC35MR-2</td><td>3.2 $^{+0.98}_{0}$ MPa
{33 $^{+10}_{0}$ kg/cm^2}</td><td>1.41±0.1MPa
{14.4±1kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa
{33±5kg/cm^2}</td><td>1.57±0.1MPa
{16±1kg/cm^2}</td></tr>
<tr><td colspan="4">If the oil pressure ratio does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>4</td><td>Defective adjustment or malfunction of PC valve</td><td colspan="4">Referring to TESTING AND ADJUSTING, Adjusting PC valve, adjust the PC valve. If the oil pressure does not become normal after adjustment, the PC valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of servo piston</td><td colspan="4">The servo piston may have a malfunction. Check it direction.</td></tr>
<tr><td>6</td><td>Defective piston pump</td><td colspan="4">If any problem is not detected by the above checks, the cause may be lowering of performance, malfunction, or internal defect of the piston pump.</td></tr>
<tr><td>7</td><td>Malfunction of sequence valve (PC27, 30MR-2)</td><td colspan="4">If the fault does not disappear when the engine speed is increased, the sequence valve may have a malfunction. Check it directly.</td></tr>
</table>

3) Speed or power of swing and blade is low

Failure information	• Speed or power of swing and blade is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="7">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective adjustment or malfunction of gear pump relief valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td rowspan="2">Relieve blade lower circuit</td><td>PC27MR-2</td><td>20.6 ± 0.98 MPa {210 ± 10 kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure does not become normal after adjustment, the gear pump relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>2</td><td>Defective gear pump</td><td colspan="3">If the condition does not become normal after the relief valve is adjusted or replaced, the performance of the gear pump may be lowered.</td></tr>
</table>

4) Speed or power of whole work equipment and blade is low

Failure information	• Speed or power of whole work equipment and blade is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective centralized safety valves</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Main pump pressure and gear pump relief pressure</td></tr>
<tr><td rowspan="3">• Work equipment control lever (Both directions)
• Swing control lever (Right swing)</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa {250^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26.0^{+0.98}_{-0.49}$ MPa {265^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa {270±10kg/cm²}</td></tr>
<tr><td rowspan="2">• Blade control lever (Lower)</td><td>PC27MR-2</td><td>20.6±0.98MPa {210±10kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure is lower through all of the above measurements, the centralized safety valves may be defective. Check them directly.
* The centralized safety valves act on both sides of the boom, arm, and bucket, on the head side of the boom swing, and on the bottom side of the blade.</td></tr>
</table>

5) Speed or power of travel and blade is low

Failure information	• Speed or power of travel and blade is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective center swivel joint</td><td colspan="3">1) Stop engine.
2) Plug control valve side of hydraulic hose to travel or blade system.
3) Run engine at full throttle.</td></tr>
<tr><td>Control lever</td><td colspan="2">Main pump pressure and gear pump relief pressure</td></tr>
<tr><td rowspan="3">Travel lever (Side from which hose is disconnected)</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa
{250^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26.0^{+0.98}_{-0.49}$ MPa
{265^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa
{270±10kg/cm²}</td></tr>
<tr><td rowspan="2">Blade control lever (Side from which hose is disconnected)</td><td>PC27MR-2</td><td>20.6±0.98MPa
{210±10kg/cm²}</td></tr>
<tr><td>PC30, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa
{220^{+10}_{-5} kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure becomes normal during the above measurement, the center swivel joint may be defective. Check it directly.</td></tr>
</table>

6) Speed or power of whole work equipment is low

Failure information	• Speed or power of whole work equipment is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • If a phenomenon disappears as the engine speed is increased, it is not a fault.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective seal of check valve for receiving logic valve control circuit pressure</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Right and left control levers and boom swing control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">• Operate boom, arm, and bucket in both directions.
• Swing boom to right.</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm²}</td></tr>
</table>

H-2 ENGINE SPEED LOWERS EXTREMELY OR ENGINE STALLS

Failure information	• Engine speed lowers extremely or engine stalls
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="22">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Defective adjustment or malfunction of main relief pressure</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td colspan="2" rowspan="3">Relieve arm circuit by moving arm IN</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa {250^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26.0^{+0.98}_{-0.49}$ MPa {265^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa {270±10kg/cm^2}</td></tr>
<tr><td colspan="4">If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective adjustment or malfunction of LS valve</td><td colspan="2" rowspan="2">Oil pressure to be measured</td><td colspan="2">Differential pressure</td></tr>
<tr><td>Set all levers in neutral</td><td>Curl bucket with no load (Move lever to stroke end)</td></tr>
<tr><td rowspan="3">Difference pressure between pump discharge pressure and LS valve input pressure</td><td>PC27, 30MR-2</td><td>$3.9^{+0.98}_{0}$ MPa {39.6^{+10}_{0} kg/cm^2}</td><td>1.57±0.1MPa {16±1kg/cm^2}</td></tr>
<tr><td>PC35MR-2</td><td>$3.2^{+0.98}_{0}$ MPa {33^{+10}_{0} kg/cm^2}</td><td>1.41±0.1MPa {14.4±1kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa {33±5kg/cm^2}</td><td>1.57±0.1MPa {16±1kg/cm^2}</td></tr>
<tr><td colspan="4">If the oil pressure does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>3</td><td>Defective adjustment or malfunction of PC valve</td><td colspan="4">Referring to TESTING AND ADJUSTING, Adjusting PC valve, adjust the PC valve. If the oil pressure does not become normal after adjustment, the PC valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>4</td><td>Clogging of orifice or filter in servo mechanism</td><td colspan="4">The orifice or filter in the servo mechanism may be clogged. Check them directly.</td></tr>
<tr><td>5</td><td>Malfunction of servo piston</td><td colspan="4">The servo piston may have a malfunction. Check it direction.</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Defective adjustment or malfunction of gear pump relief valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Blade control lever</td><td colspan="2">Gear pump relief pressure</td></tr>
<tr><td colspan="2" rowspan="2">Relieve blade lower circuit</td><td>PC27MR-2</td><td>20.6±0.98MPa {210±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td colspan="4">If the oil pressure does not become normal after adjustment, the relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>7</td><td>Lowering of engine output</td><td colspan="4">If any problem is not detected by checks 1 – 6 above, the cause may be lowering of the engine output. Carry out troubleshooting "S-6 Output is insufficient or power is low" in TROUBLESHOOTIN FOR ENGINE (S-mode).</td></tr>
</table>

H-3 WHOLE WORK EQUIPMENT, TRAVEL SYSTEM, SWING SYSTEM, AND BLADE DO NOT WORK

★ Check the systems which do not work according to the following table, then got the specified troubleshooting item.

○: Normal
×: Does not work

Whole work equipment	Travel	Swing	Blade	Trouble-shooting item
×	×	×	×	Go to 1)
×	×	○	○	Go to 2)
○	○	×	×	Go to 3)
×	○	○	×	Go to 4)
○	×	○	×	Go to 5)
×	○	○	○	Go to 6)

1) Whole work equipment, travel system, swing system, and blade do not work

Failure information	• Whole work equipment, travel system, swing system, and blade do not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Before starting troubleshooting, check that the electric system (solenoid circuit) is normal.

<table>
<tr><td rowspan="17">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of PPC basic pressure lock solenoid valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Position of work equipment lock lever</td><td colspan="2">Solenoid valve output pressure</td></tr>
<tr><td>LOCK</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">FREE</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa $\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective adjustment or malfunction of control circuit relief valve
(PC35, 40, 50MR-2)</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td colspan="2">Control circuit relief pressure</td></tr>
<tr><td rowspan="2">Set all levers in neutral</td><td>PC35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa $\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td colspan="3">if the oil pressure does not become normal after adjustment, the control relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Malfunction of self-reducing pressure valve (PC27, 30MR-2)</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td colspan="2">Control circuit oil pressure</td></tr>
<tr><td>Set all levers in neutral</td><td colspan="2">$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>4</td><td>Clogging of suction strainer</td><td colspan="3">If the results of 1 – 3 are normal, the strainer may be clogged. Check it directly.</td></tr>
<tr><td>5</td><td>Defective control pump (PC35, 40, 50MR-2)</td><td colspan="3">If the results of 1, 2, and 4 are normal, the control pump may be defective.</td></tr>
<tr><td>6</td><td>Defective piston pump drive shaft or damper</td><td colspan="3">Disconnect the discharge hose from the main pump, crank the engine with the starting motor, and check that oil flows out of the discharge port.</td></tr>
</table>

2) Whole work equipment and travel system do not work

Failure information	• Whole work equipment and travel system do not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="8">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Defective adjustment or malfunction of main relief valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td colspan="2">Main relief pressure</td></tr>
<tr><td rowspan="3">• Move arm IN to relieve its circuit.
• Drive machine to relieve travel circuit.</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa
{250^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26^{+0.98}_{-0.49}$ MPa
{265^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa
{270±10kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>2</td><td>Defective piston pump</td><td colspan="3">Disconnect pump discharge hose and crank the engine with the starting motor and see if oil flows out of the discharge port.</td></tr>
</table>

3) Swing and blade systems do not work

Failure information	• Swing and blade systems do not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="7">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective adjustment or malfunction of gear pump relief valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td rowspan="2">Relieve blade circuit by lowering blade</td><td>PC27MR-2</td><td>20.6±0.98MPa
{210±10kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa
{220^{+10}_{-5} kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure does not become normal after adjustment, the gear pump relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>2</td><td>Defective gear pump drive shaft or coupling</td><td colspan="3">Disconnect gear pump discharge hose and crank the engine with the starting motor and see if oil flows out of the discharge port.</td></tr>
</table>

4) Whole work equipment and blade do not work

Failure information	• Whole work equipment and blade do not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective centralized safety valves</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Main pump pressure and gear pump relief pressure</td></tr>
<tr><td rowspan="3">• Work equipment control lever (Both directions)
• Boom swing control lever (Swing to right)</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa {250^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26^{+0.98}_{-0.49}$ MPa {265^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa {270±10kg/cm^2}</td></tr>
<tr><td rowspan="2">• Blade control lever (Lower)</td><td>PC27MR-2</td><td>20.6±0.98MPa {210±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td colspan="3">If the oil pressure is lower through all of the above measurements, the centralized safety valves may be defective. Check them directly.
* The centralized safety valves act on both sides of the boom, arm, and bucket, on the head side of the boom swing, and on the bottom side of the blade.</td></tr>
</table>

5) Travel system and blade system do not work

Failure information	• Travel system and blade system do not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective center swivel joint</td><td colspan="3">1) Stop engine.
2) Plug control valve side of hydraulic hose to travel or blade system.
3) Run engine at full throttle.</td></tr>
<tr><td>Control levers</td><td colspan="2">Main pump pressure and gear pump relief pressure</td></tr>
<tr><td rowspan="3">Travel lever (on the side where hose is disconnected)</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa {250^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26.0^{+0.98}_{-0.49}$ MPa {265^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa {270±10kg/cm^2}</td></tr>
<tr><td rowspan="2">Blade lever (on the side where hose is disconnected)</td><td>PC27MR-2</td><td>20.6±0.98MPa {210±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm^2}</td></tr>
<tr><td colspan="3">If the oil pressure becomes normal during the above measurement, the center swivel joint may be defective. Check it directly.</td></tr>
</table>

6) Whole work equipment does not work

Failure information	• Whole work equipment does not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective seal of check valve for receiving logic valve control circuit pressure</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Right and left control levers and boom swing control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">• Operate boom, arm, and bucket in both directions.
• Swing boom to right.</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
</table>

H-4 ABNORMAL SOUND COMES OUT FROM AROUND HYDRAULIC PUMP

Failure information	• Abnormal sound comes out from around hydraulic pump
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="7">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Lowering of hydraulic oil level</td><td>Check directly.</td></tr>
<tr><td>2</td><td>Trouble of hydraulic oil</td><td>Hydraulic oil may contain air. Check it directly.</td></tr>
<tr><td>3</td><td>Clogging of hydraulic tank cap</td><td>The hydraulic tank cap may be clogged and negative pressure may be applied to the hydraulic tank. Check the cap directly.</td></tr>
<tr><td>4</td><td>Clogging of hydraulic tank strainer</td><td>The hydraulic tank strainer may be clogged and negative pressure may be applied to the suction circuit. Check the strainer directly.</td></tr>
<tr><td>5</td><td>Defective main pump</td><td>The main pump may have a defect in it. Check it directly.</td></tr>
<tr><td colspan="3">★ If the results of 1 – 5 above are normal, operate the machine for a while and see if the condition changes.</td></tr>
</table>

H-5 FINE CONTROL PERFORMANCE OR RESPONSE IS LOW

Failure information	• Fine control performance or response is low
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="20">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Clogging of LS circuit orifice</td><td colspan="4">The LS circuit orifice may be clogged. Check it directly.</td></tr>
<tr><td rowspan="7">2</td><td rowspan="7">Defective adjustment or malfunction of LS valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2" rowspan="2">Oil pressure to be measured</td><td colspan="2">Differential pressure</td></tr>
<tr><td>Set all levers in neutral</td><td>Curl bucket with no load (Move lever to stroke end)</td></tr>
<tr><td rowspan="3">Difference pressure between pump discharge pressure and LS valve input pressure</td><td>PC27, 30MR-2</td><td>$3.9^{+0.98}_{0}$ MPa {39.6^{+10}_{0} kg/cm²}</td><td>1.57±0.1MPa {16±1kg/cm²}</td></tr>
<tr><td>PC35MR-2</td><td>$3.2^{+0.98}_{0}$ MPa {33^{+10}_{0} kg/cm²}</td><td>1.41±0.1MPa {14.4±1kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa {33±5kg/cm²}</td><td>1.57±0.1MPa {16±1kg/cm²}</td></tr>
<tr><td colspan="4">If the oil pressure ratio does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of servo piston</td><td colspan="4">The servo piston may have a malfunction. Check it direction.</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Malfunction of unload valve
* PC35, 40, 50MR-2 has 2 sets of this valve.</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td>Machine model</td><td colspan="2">Unload pressure</td></tr>
<tr><td rowspan="3">Set all levers in neutral</td><td>PC27, 30MR-2</td><td colspan="2">$3.9^{+0.98}_{0}$ MPa {39.6^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC35MR-2</td><td colspan="2">$3.2^{+0.98}_{0}$ MPa {33^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td colspan="2">3.2±0.49MPa {33±5kg/cm²}</td></tr>
<tr><td>5</td><td>Clogging of piston pump orifice plug</td><td colspan="4">If the results of 1 – 4 above are normal, the piston pump orifice plug may be clogged. Check it directly.</td></tr>
</table>

H-6 SPEED OR POWER OF BOOM IS LOW

Failure information	• Speed or power of boom is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of right PPC valve (boom circuit)</td><td colspan="3">★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Right work equipment control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to raise boom
Operate to lower boom</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
$\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
$\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>2</td><td>Malfunction of boom control valve (spool)</td><td colspan="3">The boom control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of boom control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the boom control valve may be malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of boom control valve (lock valve) (PC35MR-2)</td><td colspan="3">The lock valve of the boom control valve may be malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction or defective seal of boom control valve (suction valve)</td><td colspan="3">The suction valve (bottom side) of the boom control valve may have a malfunction or defective seal. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction or defective seal of centralized safety-suction valves</td><td colspan="3">The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Defective boom cylinder</td><td colspan="3">★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Boom cylinder</td><td colspan="2">Leakage from cylinder</td></tr>
<tr><td>Relieve by raising boom</td><td colspan="2">10 cc/min</td></tr>
</table>

H-7 SPEED OR POWER OF ARM IS LOW

Failure information	• Speed or power of arm is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="13">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Malfunction of left PPC valve (arm circuit)</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Left work equipment control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td colspan="2">Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td colspan="2" rowspan="2">Operated to move arm IN
Operated to move arm OUT</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
$\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
$\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr style="display:none"></tr>
<tr><td>2</td><td>Malfunction of arm control valve (spool)</td><td colspan="4">The arm control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of arm control valve (pressure compensation valve)</td><td colspan="4">The pressure compensation valve of the arm control valve may be malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction or defective seal of arm control valve (suction valve)</td><td colspan="4">Since the suction valves of the arm control valve (on the bottom side and head side) may have a malfunction, check them directly.</td></tr>
<tr><td>5</td><td>Malfunction or defective seal of centralized safety-suction valves</td><td colspan="4">The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective arm cylinder</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Arm cylinder</td><td colspan="2">Leakage from cylinder</td></tr>
<tr><td colspan="2">Relieved in move-IN operation</td><td colspan="2">10 cc/min</td></tr>
</table>

H-8 SPEED OR POWER OF BUCKET IS LOW

Failure information	• Speed or power of bucket is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Malfunction of right PPC valve (bucket circuit)	★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Right work equipment control lever	PPC valve output pressure	
			Set in neutral	0MPa {0kg/cm²}	
			Operated to move CURL bucket Operated to move bucket DUMP	PC27, 30, 35MR-2	$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$
				PC40, 50MR-2	$3.72^{+0.39}_{-0.1}$ MPa $\{38^{+4}_{-1}$ kg/cm$^2\}$
	2	Malfunction of bucket control valve (spool)	The bucket control valve spool may have a malfunction. Check it directly.		
	3	Malfunction of bucket control valve (pressure compensation valve)	The pressure compensation valve of the bucket control valve may be malfunction. Check it directly.		
	4	Malfunction or defective seal of bucket control valve (suction valve)	Since the suction valves of the bucket control valve (on the bottom side and head side) may have a malfunction, check them directly.		
	5	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.		
	6	Defective bucket cylinder	★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Bucket cylinder	Leakage from cylinder	
			Relieved in move-CURL operation	10 cc/min	

H-9 SPEED OR POWER OF BOOM SWING IS LOW

Failure information	• Speed or power of boom swing is low
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Malfunction of boom swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Boom swing control pedal	PPC valve output pressure	
			Set in neutral	0MPa {0kg/cm²}	
			Swing boom to right or left	PC27, 30, 35MR-2	$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}
				PC40, 50MR-2	$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}
	2	Malfunction of boom swing control valve (spool)	The boom swing control valve spool may have a malfunction. Check it directly.		
	3	Malfunction of boom swing control valve (pressure compensation valve)	The pressure compensation valve of the boom swing control valve may have a malfunction. Check it directly.		
	4	Malfunction or defective seal of boom swing control valve (suction valve) * Only right swing	The suction valve (head side) of the boom swing control valve may have a malfunction. Check it directly.		
	5	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.		
	6	Defective boom swing cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Boom swing cylinder	Leakage from cylinder	
			Relieve at left end	10 cc/min	

H-10 WORK EQUIPMENT DOES NOT MOVE SINGLY

Failure information	• Work equipment does not move singly (while any part moves normally)	(1) Boom does not move singly. (2) Arm does not move singly. (3) Bucket does not move singly. (4) Boom swing system does not move singly.
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.	

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Malfunction of PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Work equipment control lever	PPC valve output pressure	
			Set lever in neutral	0MPa {0kg/cm²}	
			Operate lever	PC27, 30, 35MR-2	$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}
				PC40, 50MR-2	$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}
	2	Malfunction of control valve (spool)	The control valve spool may have a malfunction. Check it directly.		

H-11 WORK EQUIPMENT HYDRAULIC DRIFT IS LARGE

1) Boom hydraulic drift is large

Failure information	• Boom hydraulic drift is large
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting	
Presumed cause and standard value in normalcy	1	Defective boom cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Boom cylinder	Leakage from cylinder
			Relieve by raising boom	10 cc/min
	2	Defective seal of boom control valve (lock valve) (PC35, 40, 50MR-2)	The lock valve of the boom control valve may be defective seal. Check it directly.	
	3	Defective seal of boom control valve (spool)	The boom control valve spool may have a defective seal. Check it directly.	
	4	Defective seal of boom control valve (suction valve) (PC27, 30MR-2)	The suction valve (bottom side) of the boom control valve may have a defective seal. Check it directly.	

2) Arm hydraulic drift is large

Failure information	• Arm hydraulic drift is large
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting	
Presumed cause and standard value in normalcy	1	Defective arm cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Arm cylinder	Leakage from cylinder
			Relieved in move-CURL operation	10 cc/min
	2	Defective seal of arm control valve (spool)	The arm control valve spool may have a defective seal. Check it directly.	
	3	Defective seal of arm control valve (suction valve)	The suction valve (bottom side) of the arm control valve may have a defective seal. Check it directly.	

3) Bucket hydraulic drift is large

Failure information	• Bucket hydraulic drift is large
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting	
Presumed cause and standard value in normalcy	1	Defective bucket cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Bucket cylinder	Leakage from cylinder
			Relieved in move-CURL operation	10 cc/min
	2	Defective seal of bucket control valve (spool)	The bucket control valve spool may have a defective seal. Check it directly.	
	3	Defective seal of bucket control valve (suction valve)	The suction valve (bottom side) of the bucket control valve may have a defective seal. Check it directly.	

H-12 TIME LAG OF WORK EQUIPMENT IS LARGE

Failure information	• Time lag of work equipment is large
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

	Cause		Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Malfunction of control valve (suction valve)	The suction valve (head side) of the control valve may have a malfunction. Check it directly.

H-13 IN COMPOUND OPERATION OF WORK EQUIPMENT, SPEED OF PART LOADED MORE IS LOW

Failure information	• In compound operation of work equipment, speed of part loaded more is low
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

	Cause		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Malfunction of pressure compensation valve on less load side	The pressure compensation valve of the control valve on less load side may have a malfunction. Check it directly.		
			Combination of operations	More load side	Less load side
			RAISE boom + Move arm IN	Boom	Arm
			RAISE boom + Move arm OUT	Arm	Boom
			RAISE boom + CURL bucket	Boom	Bucket
			Move arm OUT + CURL bucket	Arm	Bucket
			LOWER boom + Move arm OUT	Arm	Boom

H-14 MACHINE DEVIATES DURING TRAVEL

1) Machine deviates during ordinary travel

Failure information	• Machine deviates during ordinary travel
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="21">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective undercarriage</td><td colspan="3">• Check that the track shoes on both sides are tensed evenly.
• Check that the front idler, rollers, etc. are free of abnormal rotation, deformation, and damage.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td rowspan="2">Operate to drive forward and in reverse</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td>Output difference between above both sides</td><td colspan="2">Max. 0.4 MPa {4 kg/cm²}</td></tr>
<tr><td>3</td><td>Defective adjustment of travel deviation adjustment orifice of pump (PC35, 40, 50MR-2)</td><td colspan="3">Adjust the travel deviation adjustment orifice of the pump.
★ See TESTING AND ADJUSTING, Testing and adjusting travel deviation.</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Malfunction of unload valve
* PC35, 40, 50MR-2 has 2 sets of this valve.</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td>Machine model</td><td>Unload pressure</td></tr>
<tr><td rowspan="3">Set all levers in neutral</td><td>PC27, 30MR-2</td><td>$3.9^{+0.98}_{0}$ MPa {39.6^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC35MR-2</td><td>$3.2^{+0.98}_{0}$ MPa {33^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa {33±5kg/cm²}</td></tr>
<tr><td>5</td><td>Malfunction of logic valve (PC35, 40, 50MR-2)</td><td colspan="3">The logic valve may have a malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of pump merge-divider valve (PC35, 40, 50MR-2)</td><td colspan="3">The pump merge-divider valve may have a malfunction. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of travel control valve (spool)</td><td colspan="3">The travel control valve spool may have a function. Check it directly.</td></tr>
<tr><td>8</td><td>Malfunction of travel control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.</td></tr>
<tr><td>9</td><td>Defective travel junction variable throttle</td><td colspan="3">The travel junction variable throttle may have a malfunction. Check it directly.</td></tr>
<tr><td>10</td><td>Defective center swivel joint</td><td colspan="3">Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction changes at this time, the center swivel joint is defective.</td></tr>
<tr><td>11</td><td>Defective travel motor</td><td colspan="3">Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction does not change at this time, the travel motor is defective.</td></tr>
<tr><td>12</td><td>Defective final drive</td><td colspan="3">The final drive may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)</td></tr>
</table>

2) Machine deviates when it starts (It does not deviate during ordinary travel)

Failure information	• Machine deviates when it starts (It does not deviate during ordinary travel)
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="8">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Malfunction of travel motor counterbalance valve</td><td colspan="3">The travel motor counterbalance valve may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to drive forward and in reverse</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td>3</td><td>Defective travel motor holding brake</td><td colspan="3">If the results of 1 and 2 above are normal, release of the travel motor holding brake may be delayed. Check the parking brake directly.</td></tr>
</table>

H-15 TRAVEL SPEED OR TRAVEL POWER IS LOW (WHILE WORK EQUIPMENT IS NORMAL)

Failure information	• Travel speed or travel power is low (while work equipment is normal)
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that the machine does not deviate during travel.

<table>
<tr><td rowspan="21">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective undercarriage</td><td colspan="3">• Check that the track shoes on both sides are tensed evenly.
• Check that the front idler, rollers, etc. are free of abnormal rotation, deformation, and damage.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td rowspan="2">Operate to drive forward and in reverse</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td>Output difference between above both sides</td><td colspan="2">Max. 0.4 MPa {4 kg/cm²}</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Malfunction of unload valve
* PC35, 40, 50MR-2 has 2 sets of this valve.</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control levers</td><td>Machine model</td><td>Unload pressure</td></tr>
<tr><td rowspan="3">Set all levers in neutral</td><td>PC27, 30MR-2</td><td>$3.9^{+0.98}_{0}$ MPa {39.6^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC35MR-2</td><td>$3.2^{+0.98}_{0}$ MPa {33^{+10}_{0} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>3.2±0.49MPa {33±5kg/cm²}</td></tr>
<tr><td>4</td><td>Malfunction of logic valve (PC35, 40, 50MR-2)</td><td colspan="3">The logic valve may have a malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of pump merge-divider valve (PC35, 40, 50MR-2)</td><td colspan="3">The pump merge-divider valve may have a malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of travel control valve (spool)</td><td colspan="3">The travel control valve spool may have a function. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of travel control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="5">8</td><td rowspan="5">Defective adjustment or malfunction of main relief valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Lever to be operated</td><td colspan="2">Main relief pressure</td></tr>
<tr><td rowspan="3">Travel lever operated to relieve</td><td>PC27MR-2</td><td>$24.5^{+0.98}_{-0.49}$ MPa {250^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC30, 35MR-2</td><td>$26.0^{+0.98}_{-0.49}$ MPa {265^{+10}_{-5} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>26.5±0.98MPa {270±10kg/cm²}</td></tr>
</table>

H-16 MACHINE IS NOT STEERED WELL OR STEERING POWER IS LOW

Failure information	• Machine is not steered well or steering power is low
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="13">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set both sides in neutral</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">Operate 1 side</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of logic valve (PC35, 40, 50MR-2)</td><td colspan="3">The logic valve may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of travel junction variable throttle valve</td><td colspan="3">The travel junction variable throttle valve may have a malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of pump merge-divider valve (PC35, 40, 50MR-2)</td><td colspan="3">The pump merge-divider valve may have a malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of travel control valve (spool)</td><td colspan="3">The travel control valve spool may have a function. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of travel control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of travel control valve (suction valve) (PC35, 40, 50MR-2)</td><td colspan="3">The suction valve of the travel control valve may have a malfunction. Check it directly.</td></tr>
<tr><td>8</td><td>Defective center swivel joint seal</td><td colspan="3">The center swivel joint seal may be defective. Check it directly.</td></tr>
</table>

H-17 TRAVEL SPEED DOES NOT CHANGE

Failure information	• Travel speed does not change or it is low or high
Relative information	• Before starting troubleshooting, check that the electric system is normal. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

	Cause		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Malfunction of travel speed shifting solenoid valve	★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			2nd travel speed selection switch	Solenoid valve output pressure	
			OFF (Monitor lamp goes OFF)	0MPa {0kg/cm²}	
			ON (Monitor lamp lights up)	PC27, 30, 35MR-2	$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}
				PC40, 50MR-2	$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}
	2	Malfunction of travel motor (speed shifting section)	If the oil pressure in 1 above is normal, the speed shifting section of the travel motor may have a malfunction.		

H-18 TRAVEL MOTOR DOES NOT WORK

1) Travel motors on both sides do not work (PC35, 40, 50MR-2)

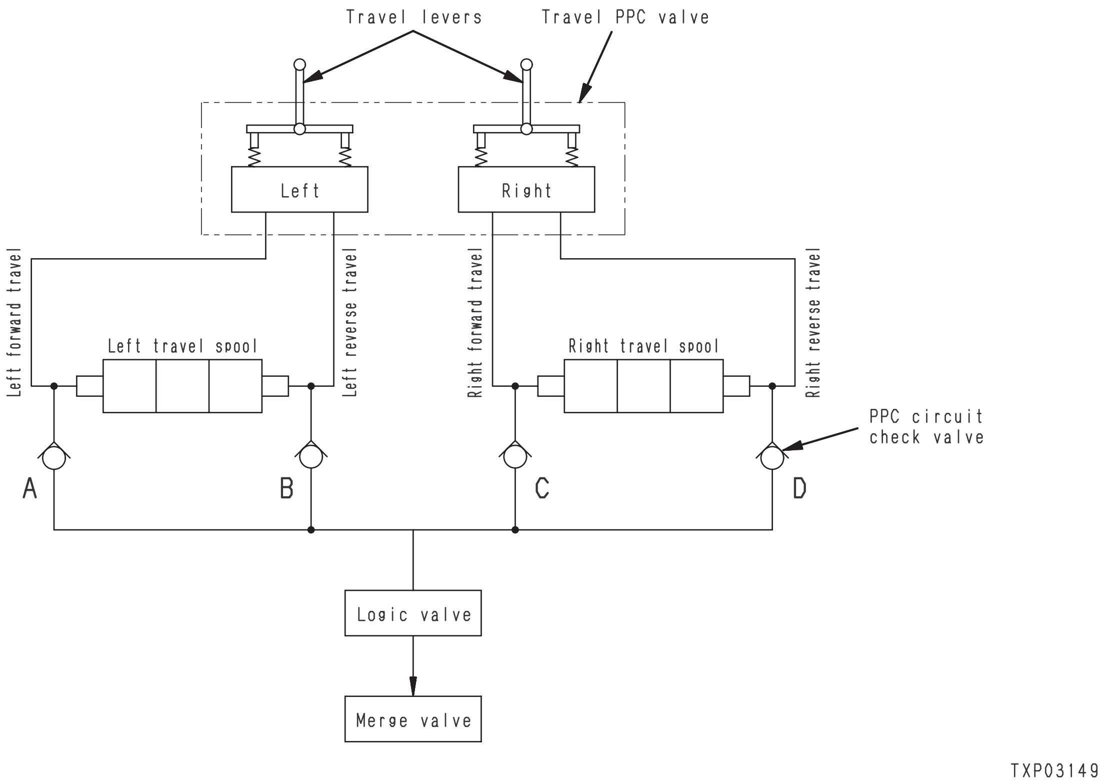
Failure information	• Travel motors on both sides do not work (PC35, 40, 50MR-2)
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

	Cause		Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Defective PPC circuit check valve (for pump merge-divider valve drive pressure)	If the PPC circuit pressure of only 1 of the left travel (forward and reverse) and right travel (forward and reverse) systems is normal, the PPC circuit check valve of that system may have a malfunction. Check it directly.

[Remarks]
Relationship between defect of PPC circuit check valve and "Travel motor does not work"

PPC circuit check valves **A** – **D** are installed as shown in the following figure to take out the signal pressure for changing the pump merge valve from the travel PPC pressure.
If the checking function of check valves **A** – **D** is lost, the travel motors may not work.

Example: When checking function of **A** is lost
- Operation in which travel motors work normally: "Left forward", "Left forward + Right forward", "Left forward + Right reverse"
- Operation in which travel motors may not work normally: "Left reverse", "Right forward", "Right reverse", "Left reverse + Right forward", "Left reverse + Right reverse"



2) Travel motor on only one side does not work

Failure information	• Travel motor on only one side does not work
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective seat of travel control valve (suction valve) (PC35, 40, 50MR-2)	The seat of the suction valve of the travel control valve may have a malfunction. Check it directly.		
	2	Malfunction of travel motor (counterbalance valve)	The counterbalance valve of the travel motor may have a malfunction. Check it directly.		
	3	Defective travel motor	Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction does not change at this time, the travel motor is defective.		
	4	Defective final drive	The final drive may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)		
	5	Malfunction of travel PPC valve	★Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Travel lever	PPC valve output pressure	
			Set in neutral	0MPa {0kg/cm²}	
			Operate for forward or reverse travel	PC27, 30, 35MR-2	$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}
				PC40, 50MR-2	$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}
	6	Malfunction travel control valve spool	The travel control valve spool may have a malfunction. Check it directly.		

H-19 SPEED OR POWER OF SWING IS LOW

1) Speed or power of swing is low in both directions

<table>
<tr><td>Failure information</td><td>• Speed or power of swing is low in both directions</td></tr>
<tr><td>Relative information</td><td>• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper.
• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.
• Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)</td></tr>
</table>

<table>
<tr><td rowspan="17">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective adjustment or malfunction of swing motor safety valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td rowspan="2">Relieve by swinging
(in both directions respectively).</td><td>PC27MR-2</td><td>18.1±0.98MPa
{185±10kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>19.6±0.98MPa
{200±10kg/cm²}</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of swing motor holding brake</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td rowspan="2">Operate to move arm IN or swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective swing machinery</td><td colspan="3">The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Malfunction of swing control valve spool</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing PPC circuit pressure</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Internal defect of swing motor</td><td colspan="3">If the results of 1 – 4 above are normal, the swing motor may have a defect in it. Check it directly.</td></tr>
</table>

2) Speed or power of swing is low in only 1 direction

Failure information	• Speed or power of swing is low in only 1 direction
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Malfunction of swing PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa $\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Malfunction of swing control valve spool</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing PPC circuit pressure</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa $\{30^{+5}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa $\{38^{+4}_{-1}$ kg/cm$^2\}$</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr></tr>
<tr><td>3</td><td>Defective seal of swing motor suction valve or check valve</td><td colspan="3">The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.</td></tr>
</table>

H-20 MACHINE DOES NOT SWING

1) Machine does not swing in either direction

Failure information	• Machine does not swing in either direction
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-3, 3) first.)

<table>
<tr><td rowspan="22">Presumed cause and standard value in normalcy</td><th colspan="2">Cause</th><th colspan="3">Standard value in normalcy and references for troubleshooting</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective adjustment or malfunction of swing motor safety valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td rowspan="2">Relieve by swinging
(in both directions respectively).</td><td>PC27MR-2</td><td>18.1±0.98MPa
{185±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>19.6±0.98MPa
{200±10kg/cm^2}</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of swing motor holding brake</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td rowspan="2">Operate to move arm IN or swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective swing machinery</td><td colspan="3">The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Malfunction of swing control valve spool</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing PPC circuit pressure</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Malfunction of check valve in swing holding brake release pressure pickup circuit</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td rowspan="2">Operated to move arm IN or swing to right and left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If oil pressure in any hydraulic circuit is defective, the check valves of the right and left swing PPC circuits and arm IN PPC circuit may have a malfunction. Check those valves directly.</td></tr>
<tr><td>6</td><td>Internal defect of swing motor</td><td colspan="3">If the results of 1 – 5 above are normal, the swing motor may have a defect in it. Check it directly.</td></tr>
</table>

2) Machine does not swing in only 1 direction

Failure information	• Machine does not swing in only 1 direction
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-3, 3) first.)

<table>
<tr><td rowspan="18">Presumed cause and standard value in normalcy</td><th colspan="2">Cause</th><th colspan="3">Standard value in normalcy and references for troubleshooting</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of swing PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of swing control valve spool</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing PPC circuit pressure</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective seal of swing motor suction valve or check valve</td><td colspan="3">The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of load check valve in control valve spool</td><td colspan="3">Since the load check valve in the control valve spool may have a malfunction, check it directly.</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Malfunction of check valve in swing holding brake release pressure pickup circuit</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td rowspan="2">Operated to move arm IN or swing to right and left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td colspan="3">If oil pressure in any hydraulic circuit is defective, the check valves of the right and left swing PPC circuits and arm IN PPC circuit may have a malfunction. Check those valves directly.</td></tr>
</table>

H-21 SWING ACCELERATION PERFORMANCE IS LOW

1) Swing acceleration performance is low in both directions

Failure information	• Swing acceleration performance is low in both directions
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

<table>
<tr><td rowspan="15">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective adjustment or malfunction of swing motor safety valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td rowspan="2">Relieve by swinging
(in both directions respectively).</td><td>PC27MR-2</td><td>18.1±0.98MPa
{185±10kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>19.6±0.98MPa
{200±10kg/cm²}</td></tr>
<tr></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of swing motor holding brake</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td rowspan="2">Operate to move arm IN or swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective swing machinery</td><td colspan="3">The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)</td></tr>
<tr><td>4</td><td>Internal defect of swing motor</td><td colspan="3">If the results of 1 – 3 above are normal, the swing motor may have a defect in it. Check it directly.</td></tr>
</table>

2) Swing acceleration performance is low in only 1 direction

<table>
<tr><td>Failure information</td><td>• Swing acceleration performance is low in only 1 direction</td></tr>
<tr><td>Relative information</td><td>• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper.
• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.
• Check that he blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)</td></tr>
</table>

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of swing PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of swing control valve spool</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing PPC circuit pressure</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td colspan="3">If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective seal of swing motor suction valve or check valve</td><td colspan="3">The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of load check valve in control valve spool</td><td colspan="3">Since the load check valve in the control valve spool may have a malfunction, check it directly.</td></tr>
</table>

H-22 MACHINE OVERRUNS WHEN IT STOPS SWINGING

1) Machine overruns when it stops swinging in both directions

Failure information	• Machine overruns when it stops swinging in both directions
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective adjustment of swing motor safety valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td rowspan="2">Relieve by swinging
(in both directions respectively).</td><td>PC27MR-2</td><td>18.1±0.98MPa
{185±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>19.6±0.98MPa
{200±10kg/cm^2}</td></tr>
<tr><td>2</td><td>Defective swing motor</td><td colspan="3">If the result of 1 above is normal, the swing motor may have a defect in it. Check it directly.</td></tr>
</table>

2) Machine overruns when it stops swinging in only 1 direction

Failure information	• Machine overruns when it stops swinging in both directions
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="13">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of swing PPC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left control lever</td><td colspan="3">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="3">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">Operate to swing to right or left</td><td>PC27, 30, 35MR-2</td><td colspan="2">$2.94^{+0.49}_{-0.1}$ MPa
{30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td colspan="2">$3.72^{+0.39}_{-0.1}$ MPa
{38^{+4}_{-1} kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of swing control valve (spool)</td><td colspan="4">The swing control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective adjustment or malfunction of swing motor (safety valve)</td><td colspan="4">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Swing lock switch</td><td>Left control lever</td><td colspan="2">Swing relief pressure</td></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Operate to relieve by swinging (in both directions respectively)</td><td>PC27MR-2</td><td>18.1±0.98MPa
{185±10kg/cm^2}</td></tr>
<tr><td>PC30, 35, 40, 50MR-2</td><td>19.6±0.98MPa
{200±10kg/cm^2}</td></tr>
<tr><td>4</td><td>Defective seal of swing motor (suction valve)</td><td colspan="4">The seal of the suction valve of the swing motor may be defective. Check it directly.</td></tr>
</table>

H-23 LARGE SHOCK IS MADE WHEN MACHINE STOPS SWINGING

Failure information	• Large shock is made when machine stops swinging
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, set the hydraulic oil temperature to 45 – 55°C.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Malfunction of swing PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Left work equipment control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm^2}</td></tr>
<tr><td rowspan="2">Operated to swing machine</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm^2}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm^2}</td></tr>
<tr></tr>
<tr><td>2</td><td>Malfunction of swing motor safety valve</td><td colspan="3">Since the swing motor safety valve may have a malfunction, check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of control valve spool</td><td colspan="3">Since the control valve spool may have a malfunction, check it directly.</td></tr>
</table>

H-24 WHEN UPPER STRUCTURE STOPS SWINGING, IT MAKES LARGE SOUND

Failure information	• When upper structure stops swinging, it makes large sound
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="5">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Malfunction of back pressure check valve</td><td>The back pressure check valve may have a malfunction. Check it directly.</td></tr>
<tr><td>2</td><td>Malfunction of swing motor (safety valve)</td><td>The swing motor (safety valves) may have a malfunction. Check the valves directly.</td></tr>
<tr><td>3</td><td>Malfunction of swing motor (suction valves)</td><td>The swing motor (suction valves) may have a malfunction. Check the valves directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)</td></tr>
<tr><td>4</td><td>Swing machinery defective</td><td>The swing machinery may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)</td></tr>
</table>

H-25 HYDRAULIC DRIFT OF SWING IS LARGE

1) Hydraulic drift of swing is large (while swing holding brake is applied)

Failure information	• Hydraulic drift of swing is large (when swing holding brake is applied)
Relative information	• When the control levers on the swing and arm IN side are in neutral, the swing holding brake operates and the upper structure is fixed by the disc brake.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction or internal defect of swing motor (holding brake section)</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Swing motor holding brake release pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to swing</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">If the above hydraulic pressure is normal, the holding brake section of the swing motor may have a malfunction or a defect in it. Check it directly.</td></tr>
</table>

2) Hydraulic drift of swing is large (while swing holding brake is released)

Failure information	• Hydraulic drift of swing is large (while swing holding brake is released)
Relative information	• If the arm is moved IN, the swing brake is released and the upper structure is held by only hydraulic pressure.

<table>
<tr><td rowspan="4">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective seal of swing control valve (spool)</td><td>The seal of the swing control valve spool may be defective. Check it directly.</td></tr>
<tr><td>2</td><td>Defective seal of swing control valve (safety valve)</td><td>The safety valve of the swing control valve may have a malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Defective seal of swing control valve (suction valve)</td><td>The suction valve of the swing control valve may have a malfunction. Check it directly. (Replace the suction valves on both sides and judge the faulty part by the change of the phenomenon.)</td></tr>
</table>

H-26 SPEED OR POWER OF BLADE IS LOW

<table>
<tr><td>Failure information</td><td>• Speed or power of blade is low</td></tr>
<tr><td>Relative information</td><td>• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper.
• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.
• Check that the swing operation is normal. (If the swing speed is also low, carry out H-1, 3) first. If the travel speed is also low, carry out H-1, 5) first.)</td></tr>
</table>

<table>
<tr><td rowspan="17">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective adjustment of gear pump relief valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade control lever</td><td colspan="2">Gear pump relief pressure</td></tr>
<tr><td rowspan="2">Operate to lower blade</td><td>PC27MR-2</td><td>20.6±0.98MPa {210±10kg/cm²}</td></tr>
<tr><td>PC30, 35, 40, 50MR-1</td><td>$21.6^{+0.98}_{-0.49}$ MPa {220^{+10}_{-5} kg/cm²}</td></tr>
<tr><td colspan="3">If the oil pressure does not become normal after adjustment, the relief valve may have a malfunction or a defect in it. Check it directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Malfunction of PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to raise or lower blade</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td>3</td><td>Malfunction of blade control valve spool</td><td colspan="3">The blade control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Defective blade cylinder</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade cylinder</td><td colspan="2">Leakage from cylinder</td></tr>
<tr><td>Relieve by lowering blade</td><td colspan="2">10 cc/min</td></tr>
<tr><td>5</td><td>Malfunction of load check valve in control valve spool</td><td colspan="3">The load check valve in the control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of suction valve of control valve</td><td colspan="3">The suction valve of the control valve may have a malfunction. Check it directly.
* The suction valve is installed on the LOWER side of PC27, 30MR-2 and on both sides of PC35, 40, 50MR-2.</td></tr>
</table>

H-27 BLADE DOES NOT MOVE

Failure information	• Blade does not move
Relative information	• Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. • Check that the swing operation is normal. (If the machine does not swing, carry out H-3, 3) first. If the machine does not travel, carry out H-3, 5) first.)

<table>
<tr><td rowspan="10">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Malfunction of PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade control lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Set in neutral</td><td colspan="2">0MPa {0kg/cm²}</td></tr>
<tr><td rowspan="2">Operate to raise and lower blade</td><td>PC27, 30, 35MR-2</td><td>$2.94^{+0.49}_{-0.1}$ MPa {30^{+5}_{-1} kg/cm²}</td></tr>
<tr><td>PC40, 50MR-2</td><td>$3.72^{+0.39}_{-0.1}$ MPa {38^{+4}_{-1} kg/cm²}</td></tr>
<tr><td>2</td><td>Malfunction of blade control valve spool</td><td colspan="3">The blade control valve spool may have a malfunction. Check it directly.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective blade cylinder</td><td colspan="3">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade cylinder</td><td colspan="2">Leakage from cylinder</td></tr>
<tr><td>Relieve by lowering blade</td><td colspan="2">10 cc/min</td></tr>
<tr><td></td><td>4</td><td>Deformation of blade cylinder or blade</td><td colspan="3">The blade cylinder or blade is deformed. Check them directly.</td></tr>
</table>

H-28 HYDRAULIC DRIFT OF BLADE IS LARGE

Failure information	• Hydraulic drift of blade is large
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="2">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective blade cylinder</td><td colspan="2">★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.</td></tr>
<tr><td>Blade cylinder</td><td>Leakage from cylinder</td></tr>
<tr><td>Relieve by lowering</td><td>10 cc/min</td></tr>
<tr><td>2</td><td>Defective seal of blade control valve (spool)</td><td colspan="2">The seal of blade control valve spool may be defective. Check it directly.</td></tr>
<tr><td>3</td><td>Defective seal of blade control valve (suction valve)</td><td colspan="2">The seal of the suction valve (bottom side) of the blade control valve may be defective. Check it directly.
* The suction valve is installed on the bottom side of PC27, 30MR-2 and on both sides of PC35, 40, 50MR-2.</td></tr>
</table>

TROUBLESHOOTING OF MONITOR PANEL SYSTEM (M-MODE)

BEFORE STARTING M-MODE TROUBLESHOOTING 20-502
INFORMATION CONTAINED IN TROUBLESHOOTING TABLE 20-503
SYSTEM DIAGRAM RELATED TO MONITOR PANEL 20-504
M-1 WHEN STARTING SWITCH IS TURNED ON, ANY ITEM DOES NOT OPERATE 20-506
M-2 WHEN STARTING SWITCH IS TURNED ON, SOME ITEMS DO NOT OPERATE 20-508
M-3 ALARM BUZZER IS ABNORMAL 20-509
M-4 ENGINE OIL PRESSURE CAUTION IS TURNED ON 20-511
M-5 CHARGE LEVEL CAUTION IS TURNED ON 20-512
M-6 PREHEATING SYSTEM DOES NOT OPERATE OR PREHEATER DOES NOT BECOME HOT 20-516
M-7 COOLANT TEMPERATURE GAUGE IS ABNORMAL 20-518
M-8 FUEL LEVEL GAUGE IS ABNORMAL 20-523
M-9 SERVICE METER DOES NOT OPERATE WHILE ENGINE IS RUNNING 20-527
M-10 2ND TRAVEL SPEED IS NOT SELECTED 20-529
M-11 WORKING LAMP DOES NOT LIGHT UP 20-534

BEFORE STARTING M-MODE TROUBLESHOOTING

Connection table of fuse box

★ This connection table shows the devices to which each power supply of the fuse box (FB1) supplies power directly (A switch power supply is a device which supplies power while the starting switch is at the ON position and a constant power supply is a device which supplies power while the starting switch is at the OFF position).

★ When carrying out troubleshooting related to the electric system, you should check the fuse box and fusible link to see if the power is supplied normally.

Type of power supply	Fuse No.	Fuse capacity	Destination of power
Switch power supply	1	30A	Engine stop solenoid
	2	10A	Safety relay
			Fuel pump
			PPC lock solenoid relay
			Horn switch
	3	10A	Monitor
			Alarm buzzer
			2nd travel speed selection solenoid relay, PPC lock switch
	4	10A	Arm crane
			—
	5	10A	Air conditioner, heater
			Travel alarm
	6	20A	Room lamp
			Radio
			Wiper motor
			Windshield washer motor
Constant power supply (fusible link 45A: M4)	7	10A	Radio
			Monitor panel
			Arm crane controller
	8	10A	Working lamp relay
—	9	—	(Spare)
	10	—	(Spare)

INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

Failure information	Phenomena occurring on machine
Relative information	Information on the failure occurred as well as the troubleshooting

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td>Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td rowspan="5">Cause that presumably triggered failure in question (The assigned No. is for filing purpose only. It does not stand for any priority)</td><td rowspan="5"><Content Included>
• Standard value in normalcy by which to pass "Good" or "No good" judgement over the presumed cause
• Reference for passing the above "Good" or "No Good" judgement

<Phenomenon of Wiring Harness Failure>
• Disconnection
There is a faulty contact at the connector or disconnection of wiring harness occurred.
• Defective grounding
A wiring harness that is not connected with a grounding circuit has a contact with the grounding circuit.
• Short-circuiting
A wiring harness that is not connected with a 12 V electric circuit has a contact with the electric circuit.

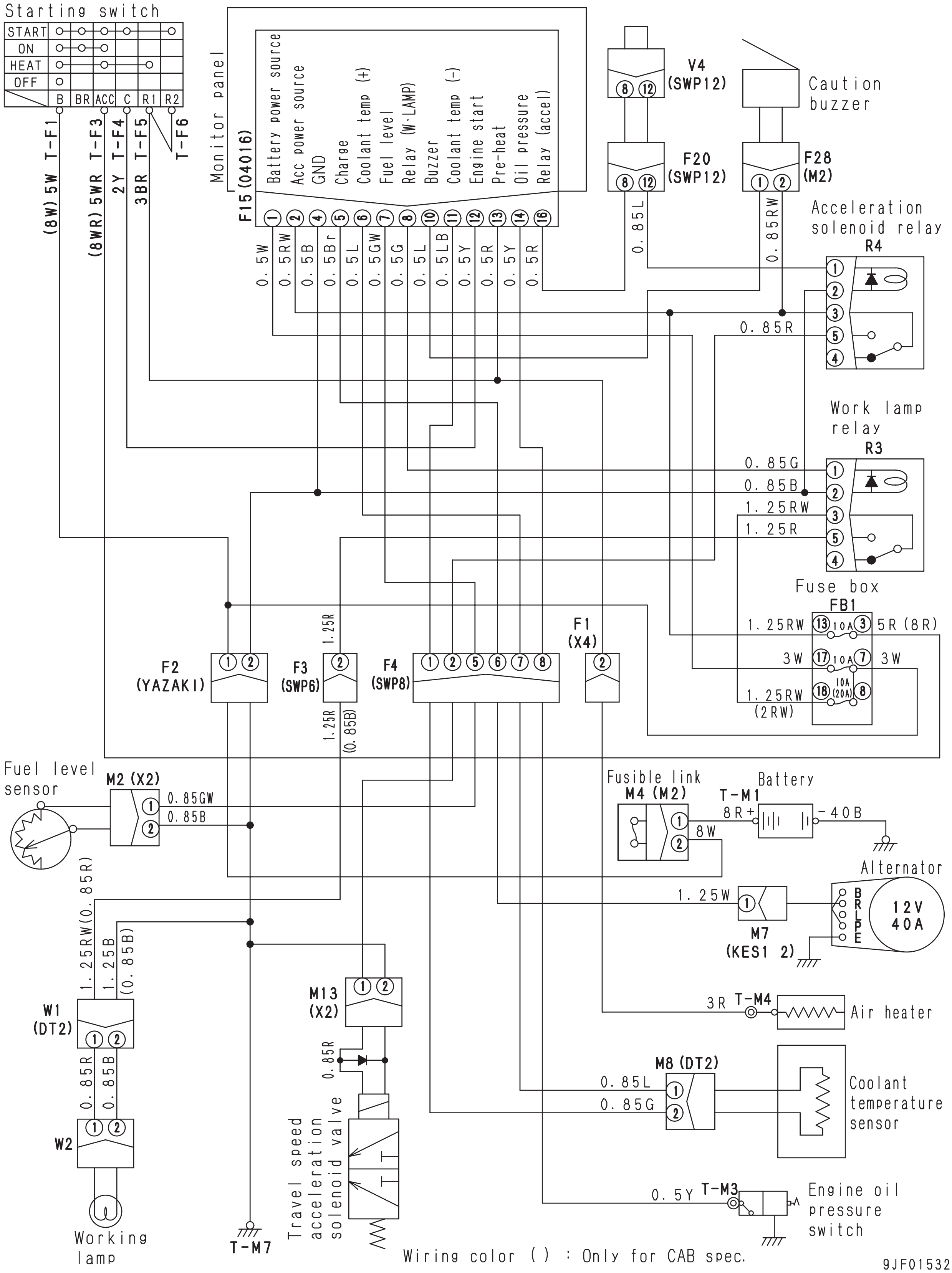
<Precaution for Troubleshooting>
1) Connector No. display method and handling of T-adapter
Insert or connect T-adapters in the following manner before starting troubleshooting unless otherwise instructed.
• If there is no indication of "male" or "female" in a specific connector No., disconnect the connector and insert the T-adapter into both male and female sides.
• If there is an indication of "male" or "female" in a specific connector No., disconnect the connector and connect the T-adepter with only one side of either "male" or "female".
2) Entry sequence of pin No. and handling of circuit tester lead
Connect the positive (+) lead and the negative (–) lead OFF a circuit tester in the following manner unless otherwise instructed.
• Connect the positive (+) lead with the pin No. indicated at the front or the wiring harness.
• Connect the negative (–) lead with the pin No. indicated at the front or the wiring harness.</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
</table>

Relative circuit diagram

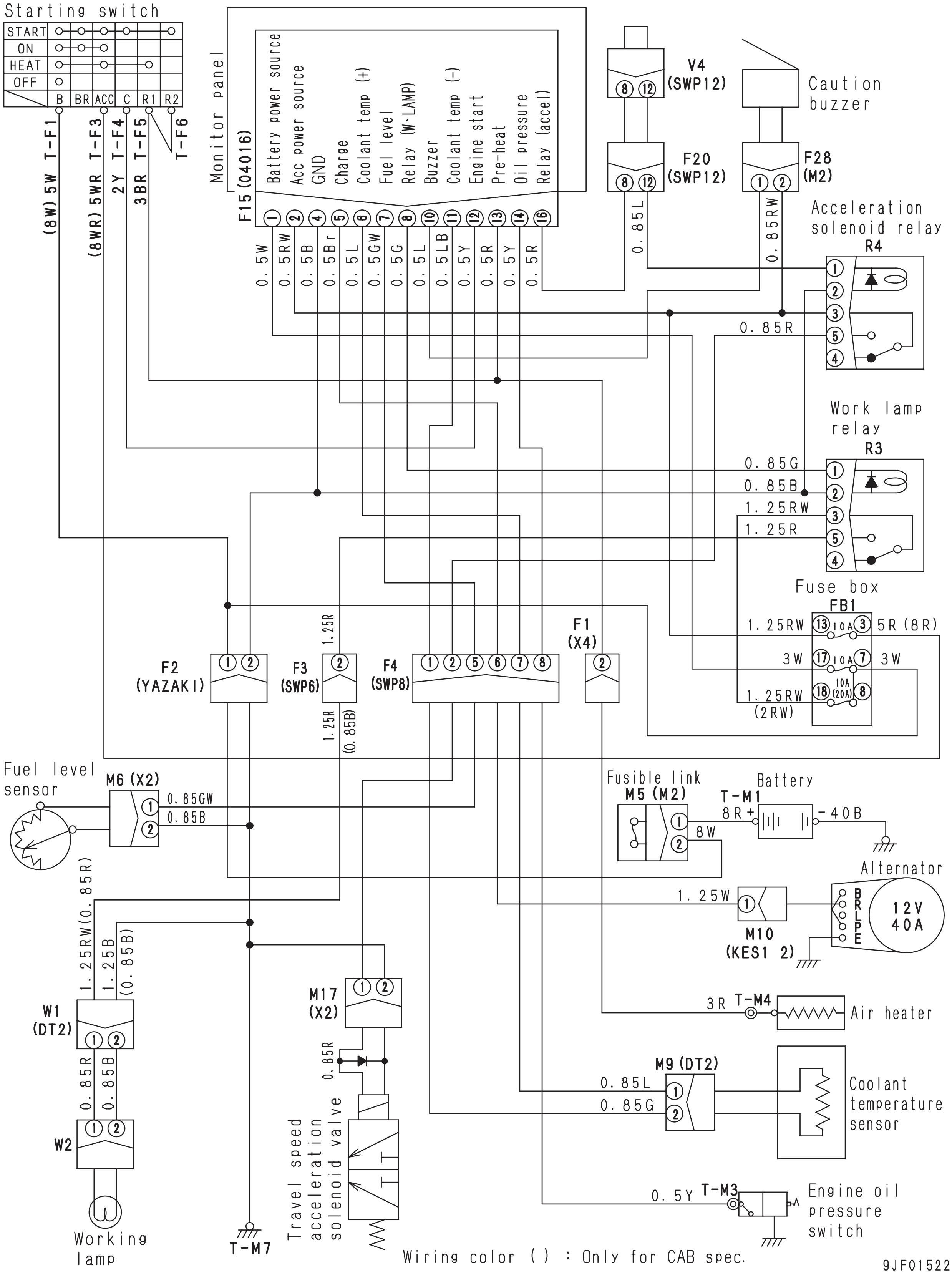
This is part of the electrical circuit diagram which shows the portion where the failure occurred.
• Connector No.: Indicates (Type - numbers of a pin) (color)

SYSTEM DIAGRAM RELATED TO MONITOR PANEL

PC27, 30, 35MR-2



PC40, 50MR-2

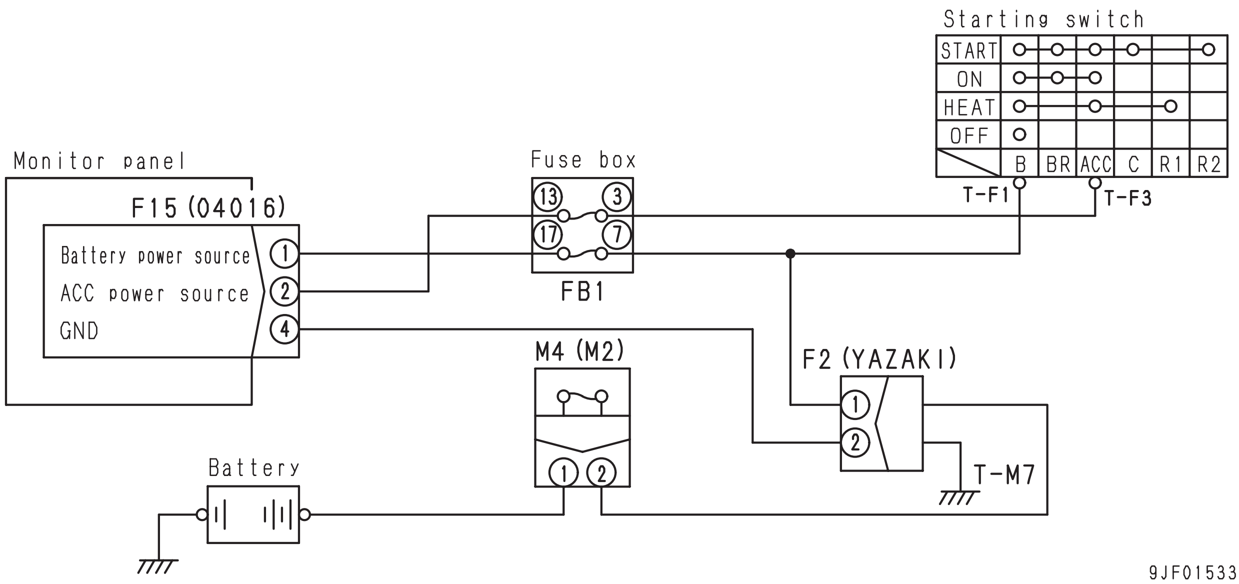

Starting switch
START
ON
HEAT
OFF
B BR ACC C R1 R2
(8W) 5W T-F1
(8WR) 5WR T-F3
2Y T-F4
3BR T-F5
T-F6
Monitor panel
F15 (04016)
Battery power source
Acc power source
GND
Charge
Coolant temp (+)
Fuel level
Relay (W·LAMP)
Buzzer
Coolant temp (-)
Engine start
Pre-heat
Oil pressure
Relay (accel)
0.5W 0.5RW 0.5B 0.5Br 0.5L 0.5GW 0.5G 0.5L 0.5LB 0.5Y 0.5R 0.5Y 0.5R
V4 (SWP12)
F20 (SWP12)
Caution buzzer
F28 (M2)
0.85L
0.85RW
Acceleration solenoid relay
R4
0.85R
Work lamp relay
R3
0.85G
0.85B
1.25RW
1.25R
Fuse box
FB1
1.25RW 10A 5R (8R)
3W 10A 3W
1.25RW (2RW) 10A (20A)
F1 (X4)
F2 (YAZAKI)
F3 (SWP6)
F4 (SWP8)
1.25R
1.25R (0.85B)
Fuel level sensor
M6 (X2)
0.85GW
0.85B
Fusible link
M5 (M2)
Battery
T-M1
8R+
-40B
8W
Alternator
1.25W
M10 (KES1 2)
B R L P E
12V 40A
1.25RW (0.85R)
1.25B (0.85B)
W1 (DT2)
0.85R 0.85B
W2
Working lamp
T-M7
M17 (X2)
0.85R
Travel speed acceleration solenoid valve
3R T-M4
Air heater
M9 (DT2)
0.85L
0.85G
Coolant temperature sensor
0.5Y T-M3
Engine oil pressure switch
Wiring color ( ) : Only for CAB spec.
9JF01522

M-1 WHEN STARTING SWITCH IS TURNED ON, ANY ITEM DOES NOT OPERATE

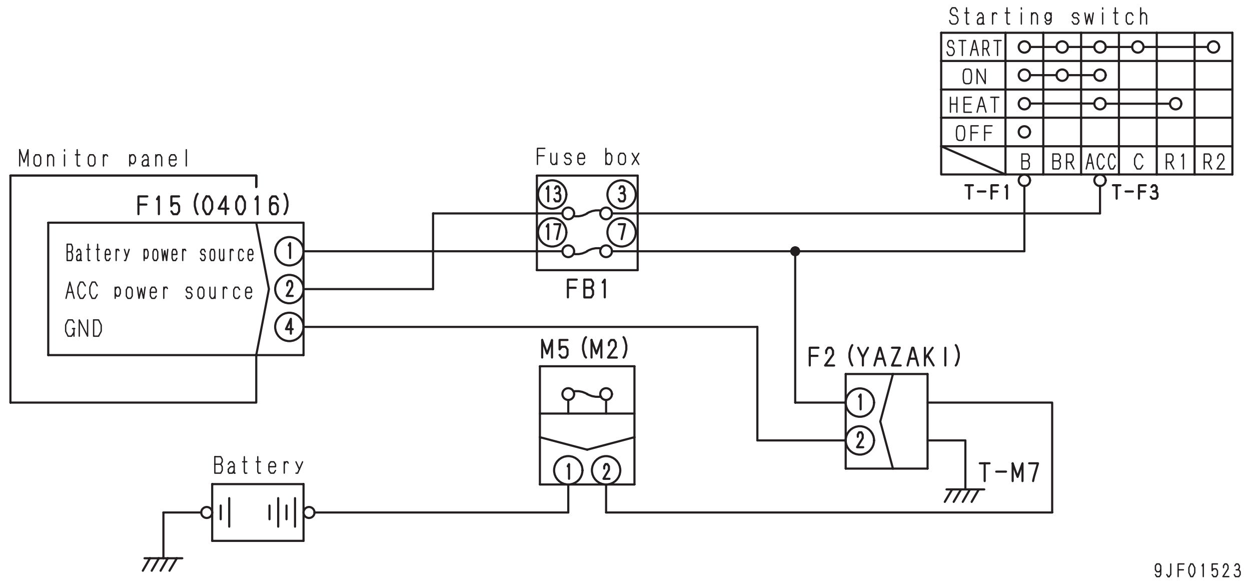
Failure information	• When the starting switch is turned from OFF to ON, the following faults occur in the self-check of the monitor panel. 1) The warning lamps and indicators do not light up (for 3 seconds). 2) The buzzer does not sound (for 1 second). • The fuel level gauge and coolant temperature gauge do not operate even a while after the starting switch is turned ON.
Relative information	• Before starting troubleshooting, check that fuses No. 3 and No. 7 and fusible link are not broken.

	Cause		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Turn starting switch ON.		
			Between F15 (female) (1) and ground	Voltage	10 – 15 V
			Between F15 (female) (2) and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Remove fuses No. 3 and No. 7. 3) Turn starting switch ON.		
			Between FB1 (7) and ground	Voltage	10 – 15 V
			Between FB1 (3) and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Remove starting switch. 3) Turn starting switch ON.		
			Between T-F1 and ground	Voltage	10 – 15 V
			Between T-F3 and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to female side of F15.		
			Wiring harness between F15 (female) (4) and ground	Resistance	Max. 1 Ω
	2	Defective monitor panel	If the floor wiring harness is normal, the monitor panel is defective.		

Relative circuit diagram (PC27, 30, 35MR-2)



Relative circuit diagram (PC40, 50MR-2)



M-2 WHEN STARTING SWITCH IS TURNED ON, SOME ITEMS DO NOT OPERATE

Failure information	• When the starting switch is turned from OFF to ON, the following faults occur in the self-check of the monitor panel. 1) Some warning lamps and indicators do not light up (for 3 seconds). 2) The buzzer does not sound (for 1 second). • The fuel level gauge and coolant temperature gauge do not operate even a while after the starting switch is turned ON.
Relative information	• Distinguish this fault from "M-1 When starting switch is turned ON, any item does not operate".

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting
	1	Defective monitor panel	See STRUCTURE AND OPERATION, Maintenance standard, "Monitor system".

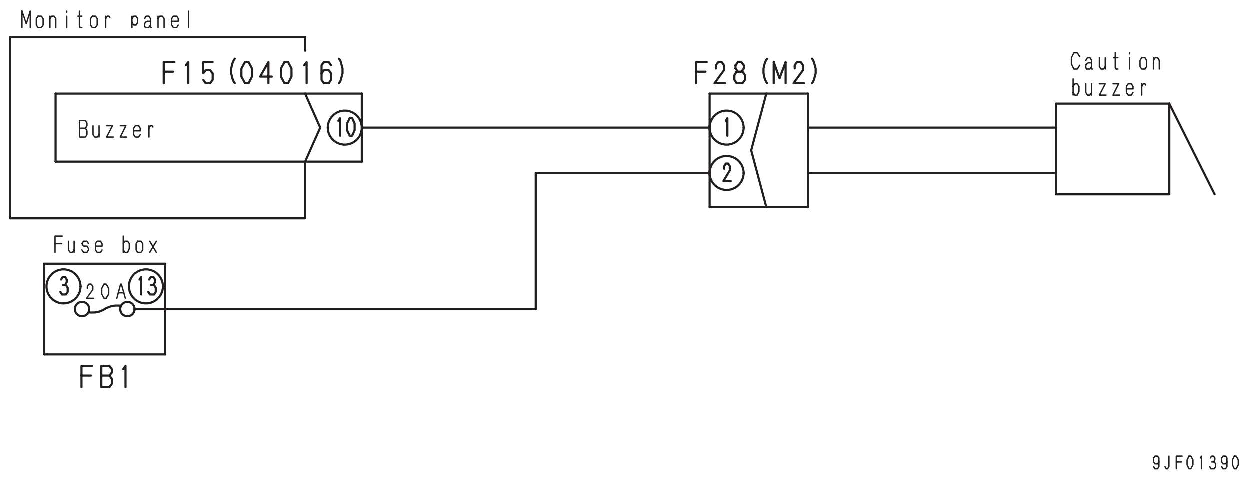
M-3 ALARM BUZZER IS ABNORMAL

1) Alarm buzzer does not sound

Failure information	• When the starting switch is turned from OFF to ON, the self-check buzzer does not sound (for 1 second). • When the starting switch turned ON and the 2nd travel speed selection switch and light switch are pressed, the selection sound (a short sound) is not heard.
Relative information	• Before starting troubleshooting, check that fuse No. 3 is not broken. • Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="9">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective monitor panel</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F15.
3) Turn starting switch ON.</td></tr>
<tr><td>Connect F15 (female) (10) to ground.</td><td>Buzzer</td><td>Sounds only when connected.</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective alarm buzzer</td><td colspan="3">1) Turn starting switch OFF.
2) Insert T-adapter in connector F28.
3) Turn starting switch ON.</td></tr>
<tr><td>Connect T-adapter box No. 1 to ground.</td><td>Buzzer</td><td>Sounds only when connected.</td></tr>
<tr><td>Between F28 (2) and ground</td><td>Voltage</td><td>10 – 15 V</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors F15 and F28.
3) Connect T-adapter to F15 (female) and F28 (female).</td></tr>
<tr><td>Wiring harness between F15 (female) (10) and F28 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between fuse (13) and F28 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

Relative circuit diagram



2) Alarm buzzer does not stop sounding

Failure information	• Alarm buzzer does not stop sounding
Relative information	• Before starting troubleshooting, check that fuse No. 3 is not broken. • Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="5">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective monitor panel</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector F15.
3) Turn starting switch ON.</td></tr>
<tr><td></td><td>Buzzer</td><td>Stops sounding.</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors F15 and F28.
3) Connect T-adapter to F15 (female) and F28 (female).</td></tr>
<tr><td>Between wiring harness between F15 (female) (10) and F28 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

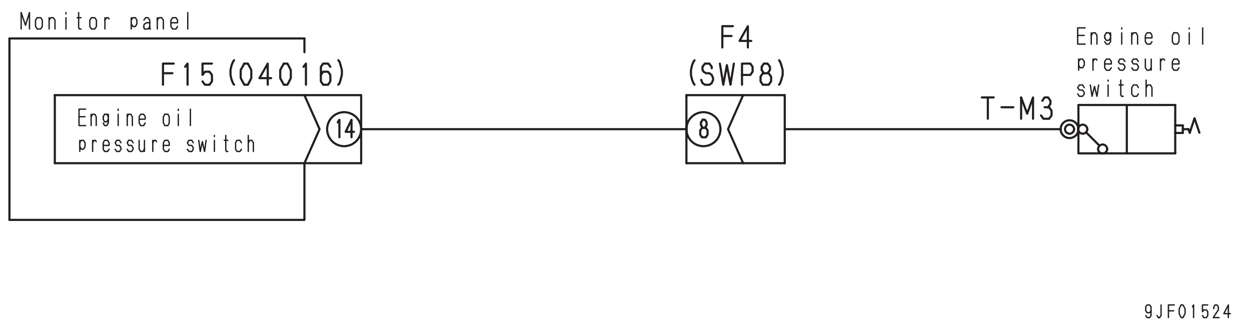
★ For the related circuit diagram, see 1).

M-4 ENGINE OIL PRESSURE CAUTION IS TURNED ON

Failure information	• The monitor panel performs the following operations to notify abnormal engine oil pressure while the engine is running. 1) The engine oil pressure caution lamp flashes. 2) The buzzer sounds.
Relative information	• Check that the engine oil pressure is normal. • When the starting switch is turned from OFF to ON, the monitor panel performs the following operations. This does not indicate a fault. 1) The engine oil pressure caution lamp and charge level caution lamp light up. 2) The buzzer does not sound.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect T-M3 and connector F15. 3) Connect T-adapter to F15 (female).		
			Between wiring harness between F15 (female) (14) and T-M3 and ground	Resistance	Min. 1 M Ω
	2	Defective monitor panel	1) Turn starting switch OFF. 2) Disconnect T-M3. 3) Start engine.		
			While T-M3 is disconnected	Oil pressure caution	Stopped
	3	Defective engine oil pressure switch	If the monitor panel and wiring harnesses are normal, the engine oil pressure switch is defective.		

Relative circuit diagram



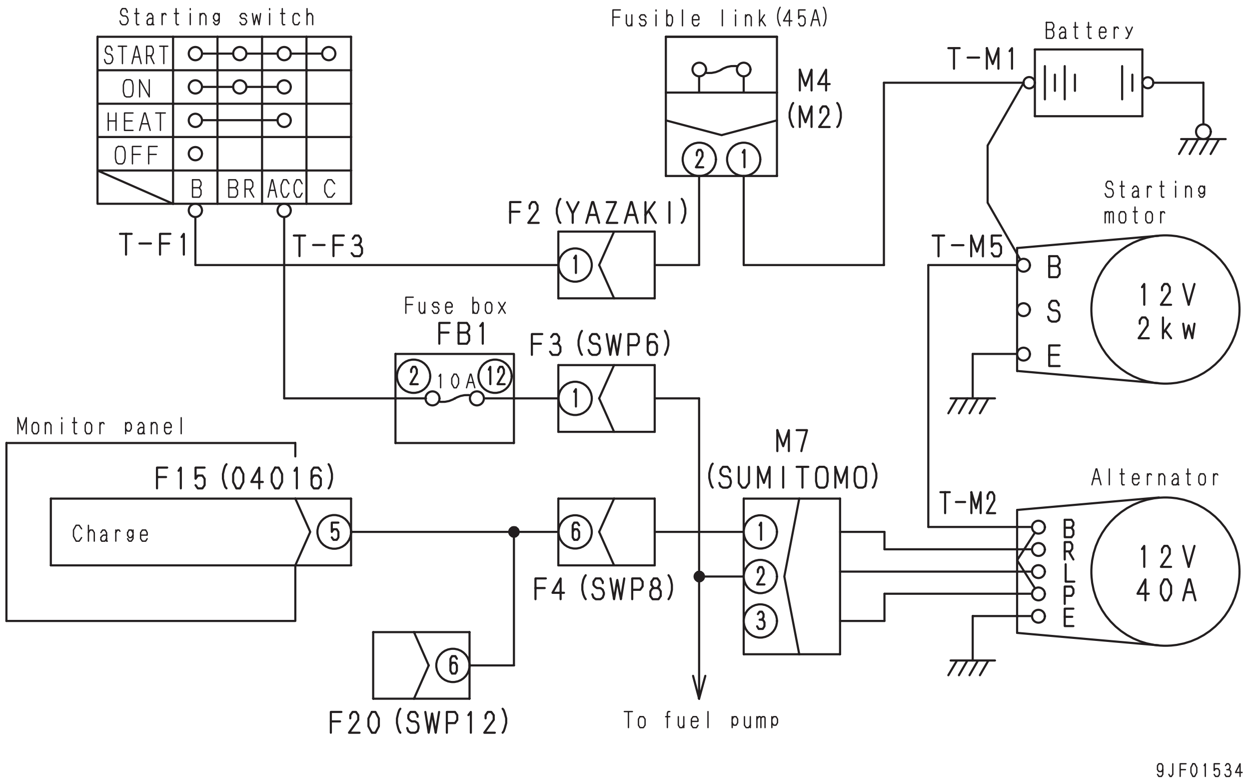
M-5 CHARGE LEVEL CAUTION IS TURNED ON

PC27, 30, 35MR-2

Failure information	• The monitor panel performs the following operations to notify abnormal charge level while the engine is running. 1) The charge level caution lamp flashes. 2) The buzzer sounds.
Relative information	• Check that the belt tension is normal. • When the starting switch is turned from OFF to ON, the monitor panel performs the following operations. This does not indicate a fault. 1) The engine oil pressure caution lamp and charge level caution lamp light up. 2) The buzzer does not sound.

<table>
<tr><td rowspan="11">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective alternator (Internal disconnection)</td><td colspan="3">1) Prepare with starting switch OFF.
2) Start engine and carry out troubleshooting.</td></tr>
<tr><td>Between M7 (1) and ground (just after starting engine)</td><td>Voltage</td><td>13.5–14.5V</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M7 and F15.
3) Connect T-adapter to female side of F15.</td></tr>
<tr><td>Wiring harness between battery (+) terminal and alternator terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M7 (female) (1), F4 (6) and F15 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M7 and F15.
3) Connect T-adapter to female side of F15.</td></tr>
<tr><td>Between wiring harness between F15 (female) (5), F4 (6) and M7 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Defective monitor panel</td><td colspan="3">1) Turn starting switch OFF.
2) Insert T-adapter in F15.
3) Start engine.</td></tr>
<tr><td>Between F15 (5) and ground (just after starting engine)</td><td>Voltage</td><td>13.5–14.5V</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)

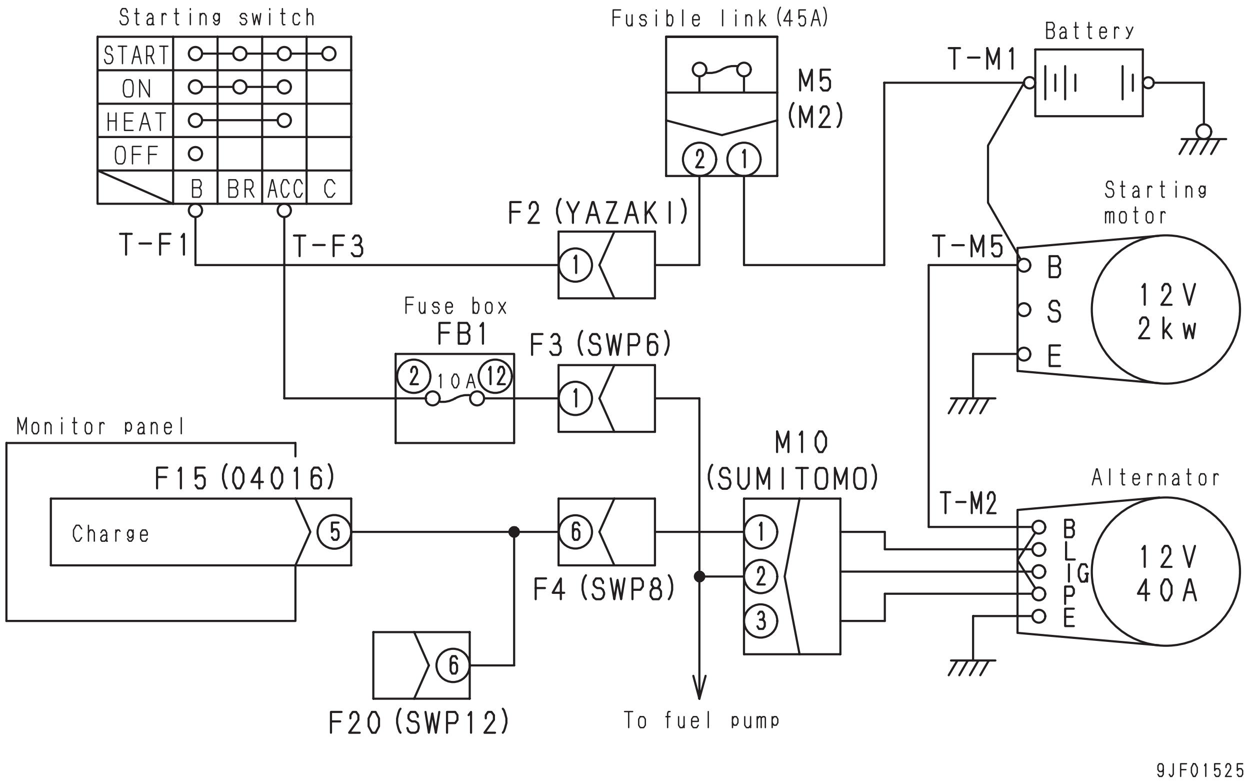


PC40, 50MR-2

Failure information	• The monitor panel performs the following operations to notify abnormal charge level while the engine is running. 1) The charge level caution lamp flashes. 2) The buzzer sounds.
Relative information	• Check that the belt tension is normal. • When the starting switch is turned from OFF to ON, the monitor panel performs the following operations. This does not indicate a fault. 1) The engine oil pressure caution lamp and charge level caution lamp light up. 2) The buzzer does not sound.

<table>
<tr><td rowspan="11">Presumed cause and standard value in normalcy</td><th colspan="2">Cause</th><th colspan="3">Standard value in normalcy and references for troubleshooting</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective alternator (Internal disconnection)</td><td colspan="3">1) Prepare with starting switch OFF.
2) Start engine and carry out troubleshooting.</td></tr>
<tr><td>Between M10 (1) and ground (just after starting engine)</td><td>Voltage</td><td>13.5–14.5V</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M10 and F15.
3) Connect T-adapter to female side of F15.</td></tr>
<tr><td>Wiring harness between battery (+) terminal and alternator terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between M10 (female) (1), F4 (6) and F15 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M10 and F15.
3) Connect T-adapter to female side of F15.</td></tr>
<tr><td>Between wiring harness between F15 (female) (5), F4 (6) and M10 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Defective monitor panel</td><td colspan="3">1) Turn starting switch OFF.
2) Insert T-adapter in F15.
3) Start engine.</td></tr>
<tr><td>Between F15 (5) and ground (just after starting engine)</td><td>Voltage</td><td>13.5–14.5V</td></tr>
</table>

Relative circuit diagram (PC40, 50MR-2)



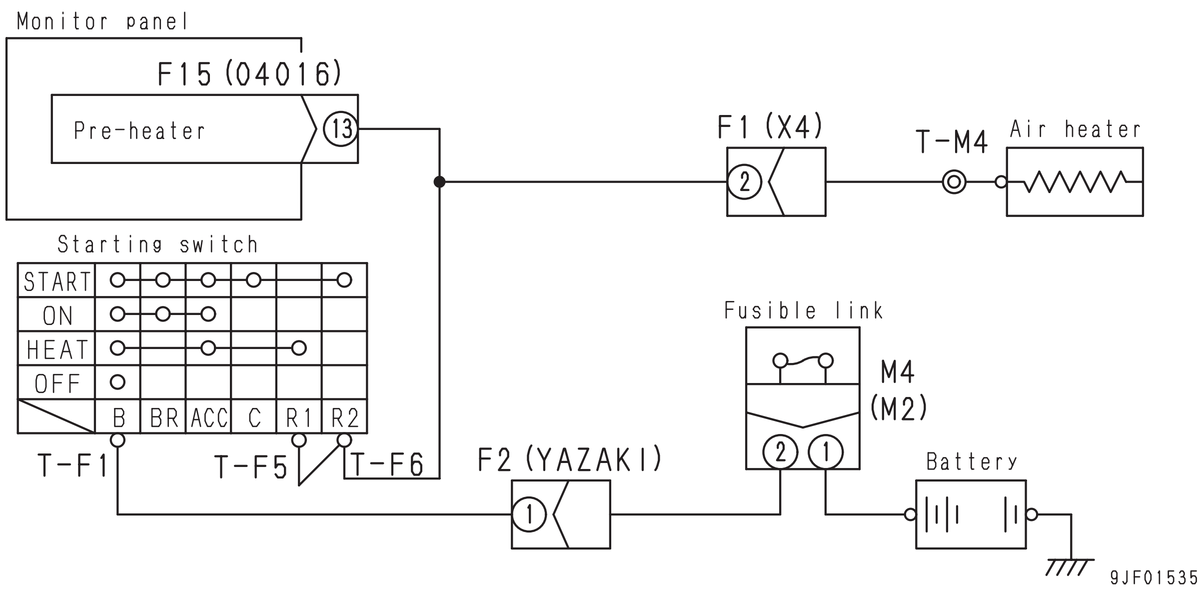
M-6 PREHEATING SYSTEM DOES NOT OPERATE OR PREHEATER DOES NOT BECOME HOT

PC27, 30, 35MR-2

Failure information	• When the starting switch is set to HEAT, the following preheating system of the monitor panel does not operate. 1) The preheating indicator flashes (for about 18 seconds). 2) The buzzer sounds at start and end of preheating.
Relative information	• Check that the fusible link is not broken. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fusible link	If the fusible link is burned, the circuit probably has a grounding fault.		
	2	Defective air heater (Internal disconnection)	1) Prepare with starting switch OFF. 2) Turn starting switch ON and carry out troubleshooting.		
			Between T-M4 and ground	Voltage	10 – 15 V
	3	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.		
			Between T-F1 and T-F5 or T-F6	Resistance	Max. 1 Ω
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connectors and terminals. 3) Connect T-adapter to female side of F15.		
			Wiring harness between T-M4, F1 (2) and T-F5 (T-F6) or F15 (female) (13)	Resistance	Max. 1 Ω
			Wiring harness between T-F1 and M4 (2) or between (1), F2 (1) and positive (+) terminal of battery	Resistance	Max. 1 Ω

Relative circuit diagram (PC27, 30, 35MR-2)

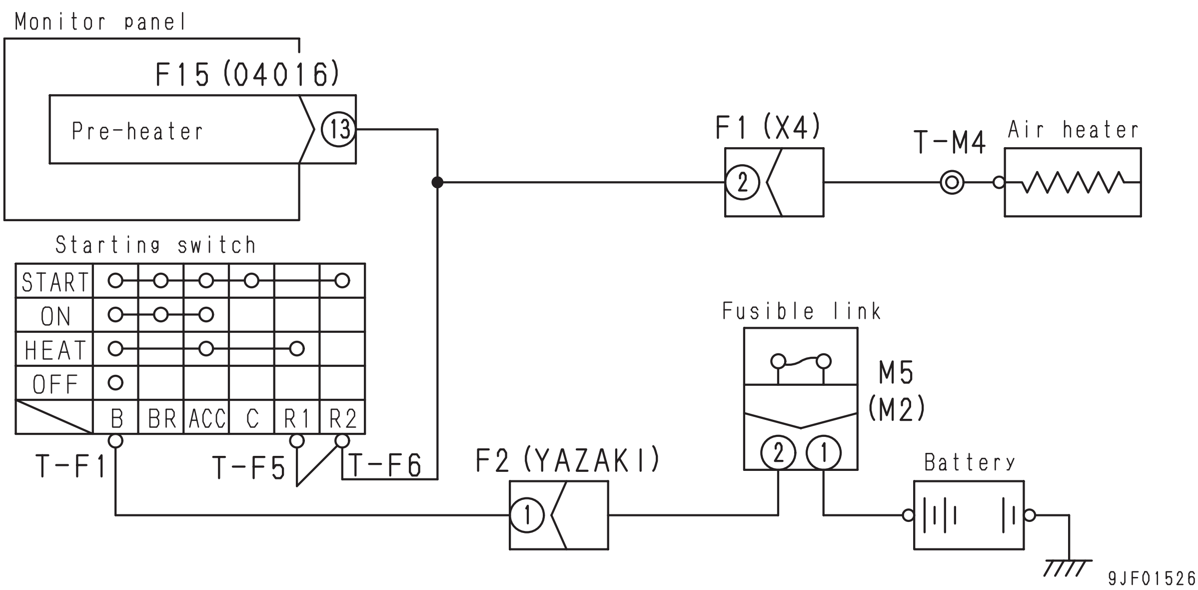


PC40, 50MR-2

Failure information	• When the starting switch is set to HEAT, the following preheating system of the monitor panel does not operate. 1) The preheating indicator flashes (for about 18 seconds). 2) The buzzer sounds at start and end of preheating.
Relative information	• Check that the fusible link is not broken. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fusible link	If the fusible link is burned, the circuit probably has a grounding fault.		
	2	Defective air heater (Internal disconnection)	1) Prepare with starting switch OFF. 2) Turn starting switch ON and carry out troubleshooting.		
			Between T-M4 and ground	Voltage	10 – 15 V
	3	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.		
			Between T-F1 and T-F5 or T-F6	Resistance	Max. 1 Ω
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connectors and terminals. 3) Connect T-adapter to female side of F15.		
			Wiring harness between T-M4, F1 (2) and T-F5 (T-F6) or F15 (female) (13)	Resistance	Max. 1 Ω
			Wiring harness between T-F1 and M5 (2) or between (1), F2 (1) and positive (+) terminal of battery	Resistance	Max. 1 Ω

Relative circuit diagram (PC40, 50MR-2)



M-7 COOLANT TEMPERATURE GAUGE IS ABNORMAL

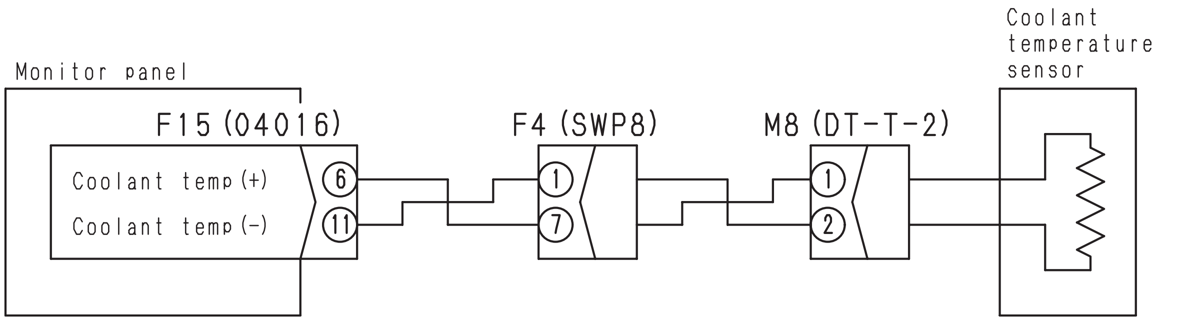
1) The pointer of the gauge does not move from C on the panel

PC27, 30, 35MR-2

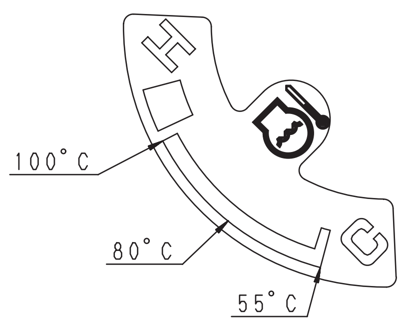
Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from C on the panel.
Relative information	• Check that the coolant temperature is normal. • While the starting switch is in OFF, the pointer does not move from C. This is not abnormal. • Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="15">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M8 and F15.
3) Connect T-adapter to M8 (female) and F15 (female).</td></tr>
<tr><td>Wiring harness between F15 (female) (6), F4 (7) and M8 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between F15 (female) (11), F4 (1) and M8 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="10">2</td><td rowspan="10">Defective coolant temperature sensor</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M8.
3) Connect T-adapter to M8 (male).</td></tr>
<tr><td>M8 (male)</td><td>Temperature</td><td>Resistance</td></tr>
<tr><td rowspan="8">Between (1) and (2)</td><td>25°C</td><td>38.18 – 47.77 kΩ</td></tr>
<tr><td>30°C</td><td>31.59 – 39.07 kΩ</td></tr>
<tr><td>80°C</td><td>6.199 – 6.935 kΩ</td></tr>
<tr><td>85°C</td><td>5.386 – 5.976 kΩ</td></tr>
<tr><td>90°C</td><td>4.469 – 5.166 kΩ</td></tr>
<tr><td>95°C</td><td>4.107 – 4.448 kΩ</td></tr>
<tr><td>100°C</td><td>3.604 – 3.903 kΩ</td></tr>
<tr><td>105°C</td><td>3.157 – 3.426 kΩ</td></tr>
<tr><td>3</td><td>Defective monitor panel</td><td colspan="3">If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)



9JF01394



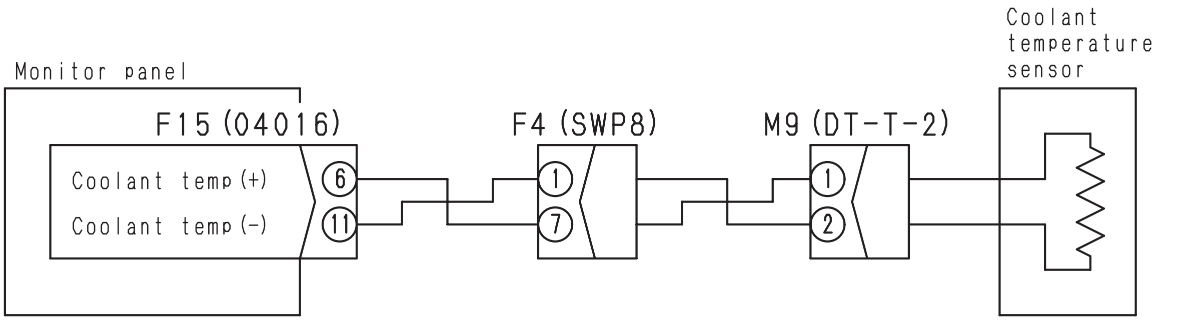
9JF01384

PC40, 50MR-2

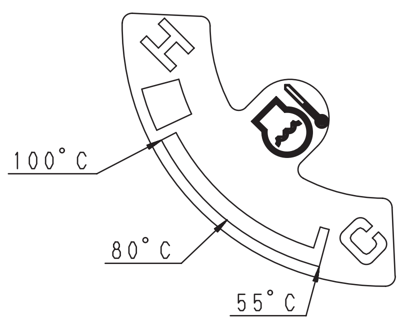
Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from C on the panel.
Relative information	• Check that the coolant temperature is normal. • While the starting switch is in OFF, the pointer does not move from C. This is not abnormal. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M9 and F15. 3) Connect T-adapter to M9 (female) and F15 (female).		
			Wiring harness between F15 (female) (6), F4 (7) and M9 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (11), F4 (1) and M9 (female) (2)	Resistance	Max. 1 Ω
	2	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M9. 3) Connect T-adapter to M9 (male).		
			M9 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 kΩ
				30°C	31.59 – 39.07 kΩ
				80°C	6.199 – 6.935 kΩ
				85°C	5.386 – 5.976 kΩ
				90°C	4.469 – 5.166 kΩ
				95°C	4.107 – 4.448 kΩ
				100°C	3.604 – 3.903 kΩ
				105°C	3.157 – 3.426 kΩ
	3	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

Relative circuit diagram (PC40, 50MR-2)



9JF01527



9JF01384

2) The pointer of the gauge does not move from H on the panel

PC27, 30, 35MR-2

Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from H on the panel.
Relative information	• Check that the coolant temperature is normal. • Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="17">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M8 and F15.
3) Connect T-adapter to M8 (female) and F15 (female).</td></tr>
<tr><td>Wiring harness between F15 (female) (6) or M8 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Wiring harness between F15 (female) (11) or M8 (female) (2) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="10">2</td><td rowspan="10">Defective coolant temperature sensor</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M8.
3) Connect T-adapter to M8 (male).</td></tr>
<tr><td>M8 (male)</td><td>Temperature</td><td>Resistance</td></tr>
<tr><td rowspan="8">Between (1) and (2)</td><td>25°C</td><td>38.18 – 47.77 kΩ</td></tr>
<tr><td>30°C</td><td>31.59 – 39.07 kΩ</td></tr>
<tr><td>80°C</td><td>6.199 – 6.935 kΩ</td></tr>
<tr><td>85°C</td><td>5.386 – 5.976 kΩ</td></tr>
<tr><td>90°C</td><td>4.469 – 5.166 kΩ</td></tr>
<tr><td>95°C</td><td>4.107 – 4.448 kΩ</td></tr>
<tr><td>100°C</td><td>3.604 – 3.903 kΩ</td></tr>
<tr><td>105°C</td><td>3.157 – 3.426 kΩ</td></tr>
<tr><td>3</td><td>Defective monitor panel</td><td colspan="3">If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.</td></tr>
</table>

★ For the related circuit diagram and panel gauges, see 1).

PC40, 50MR-2

<table>
<tr><td>Failure information</td><td>• When the starting switch is turned ON, the pointer of the gauge does not move from H on the panel.</td></tr>
<tr><td>Relative information</td><td>• Check that the coolant temperature is normal.
• Refer to troubleshooting M-1, too.</td></tr>
</table>

<table>
<tr><td rowspan="15">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M9 and F15.
3) Connect T-adapter to M9 (female) and F15 (female).</td></tr>
<tr><td>Wiring harness between F15 (female) (6) or M9 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td>Wiring harness between F15 (female) (11) or M9 (female) (2) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="10">2</td><td rowspan="10">Defective coolant temperature sensor</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M9.
3) Connect T-adapter to M9 (male).</td></tr>
<tr><td>M9 (male)</td><td>Temperature</td><td>Resistance</td></tr>
<tr><td rowspan="8">Between (1) and (2)</td><td>25°C</td><td>38.18 – 47.77 kΩ</td></tr>
<tr><td>30°C</td><td>31.59 – 39.07 kΩ</td></tr>
<tr><td>80°C</td><td>6.199 – 6.935 kΩ</td></tr>
<tr><td>85°C</td><td>5.386 – 5.976 kΩ</td></tr>
<tr><td>90°C</td><td>4.469 – 5.166 kΩ</td></tr>
<tr><td>95°C</td><td>4.107 – 4.448 kΩ</td></tr>
<tr><td>100°C</td><td>3.604 – 3.903 kΩ</td></tr>
<tr><td>105°C</td><td>3.157 – 3.426 kΩ</td></tr>
<tr><td>3</td><td>Defective monitor panel</td><td colspan="3">If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.</td></tr>
</table>

★ For the related circuit diagram and panel gauges, see 1).

3) Temperature indicated by gauge is very different from actual temperature

PC27, 30, 35MR-2

Failure information	• When the starting switch is turned ON, the temperature indicated by the gauge is very different from the actual temperature.
Relative information	• Check that the coolant temperature is normal. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M8. 3) Connect T-adapter to M8 (male).		
			M8 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 kΩ
				30°C	31.59 – 39.07 kΩ
				80°C	6.199 – 6.935 kΩ
				85°C	5.386 – 5.976 kΩ
				90°C	4.469 – 5.166 kΩ
				95°C	4.107 – 4.448 kΩ
				100°C	3.604 – 3.903 kΩ
				105°C	3.157 – 3.426 kΩ
	2	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

PC40, 50MR-2

Failure information	• When the starting switch is turned ON, the temperature indicated by the gauge is very different from the actual temperature.
Relative information	• Check that the coolant temperature is normal. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M9. 3) Connect T-adapter to M9 (male).		
			M9 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 kΩ
				30°C	31.59 – 39.07 kΩ
				80°C	6.199 – 6.935 kΩ
				85°C	5.386 – 5.976 kΩ
				90°C	4.469 – 5.166 kΩ
				95°C	4.107 – 4.448 kΩ
				100°C	3.604 – 3.903 kΩ
				105°C	3.157 – 3.426 kΩ
	2	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

M-8 FUEL LEVEL GAUGE IS ABNORMAL

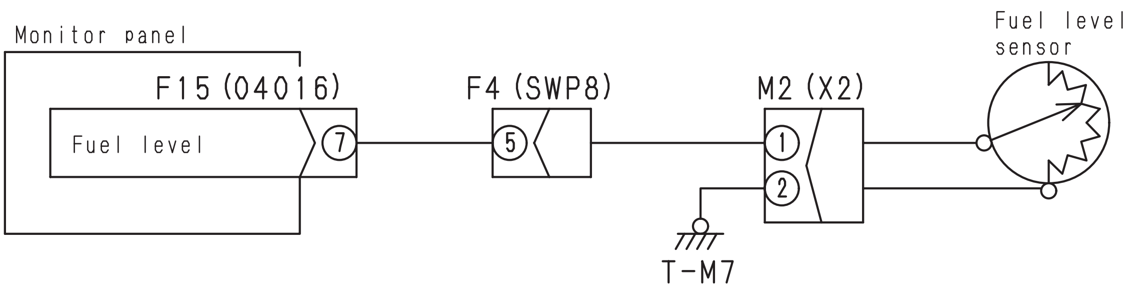
1) The pointer of the gauge does not move from E on the panel

PC27, 30, 35MR-2

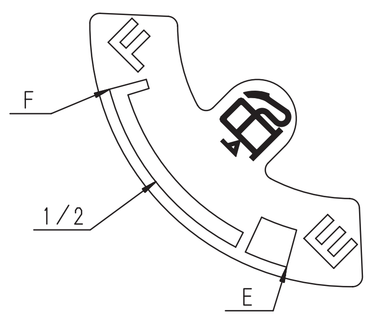
Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from E on the panel.
Relative information	• Check that the fuel level is normal. • While the starting switch is in OFF, the pointer does not move from E. This is not abnormal. • Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connectors M2 and F15.
3) Connect T-adapter to M2 (female) and F15 (female).</td></tr>
<tr><td colspan="2">Wiring harness between F15 (female) (7) and M2 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connectors M2.
3) Connect T-adapter to M2 (female).</td></tr>
<tr><td colspan="2">Wiring harness between M2 (female) (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="7">2</td><td rowspan="7">Defective fuel level sensor</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connector M2.
3) Connect T-adapter to M2 (male).</td></tr>
<tr><td>M2 (male)</td><td>Position of float</td><td colspan="2">Resistance
( ) is reference value.</td></tr>
<tr><td rowspan="5">Between (1) and (2)</td><td>FULL</td><td colspan="2">$10^{+1.0}_{-0.5}$ Ω</td></tr>
<tr><td>3/4</td><td colspan="2">(19 Ω)</td></tr>
<tr><td>1/2</td><td colspan="2">32±3 Ω</td></tr>
<tr><td>1/4</td><td colspan="2">(49.5 Ω)</td></tr>
<tr><td>EMPTY</td><td colspan="2">80^{+12}_{+2} Ω</td></tr>
<tr><td>3</td><td>Defective monitor panel</td><td colspan="4">If the wiring harness and fuel level sensor are normal, the monitor panel is defective.</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)



9JF01536



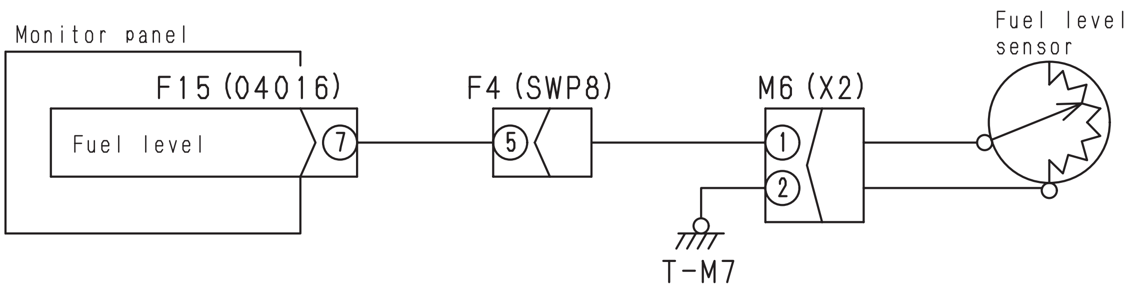
9JF01385

PC40, 50MR-2

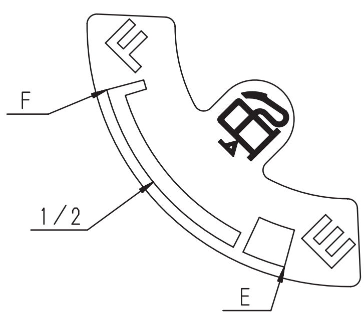
<table>
<tr><td>Failure information</td><td>• When the starting switch is turned ON, the pointer of the gauge does not move from E on the panel.</td></tr>
<tr><td>Relative information</td><td>• Check that the fuel level is normal.
• While the starting switch is in OFF, the pointer does not move from E. This is not abnormal.
• Refer to troubleshooting M-1, too.</td></tr>
</table>

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M6 and F15.
3) Connect T-adapter to M6 (female) and F15 (female).</td></tr>
<tr><td colspan="1">Wiring harness between F15 (female) (7) and M6 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connectors M6.
3) Connect T-adapter to M6 (female).</td></tr>
<tr><td>Wiring harness between M6 (female) (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="7">2</td><td rowspan="7">Defective fuel level sensor</td><td colspan="3">1) Turn starting switch OFF.
2) Disconnect connector M6.
3) Connect T-adapter to M6 (male).</td></tr>
<tr><td>M6 (male)</td><td>Position of float</td><td>Resistance
( ) is reference value.</td></tr>
<tr><td rowspan="5">Between (1) and (2)</td><td>FULL</td><td>$10^{+1.0}_{-0.5}$ Ω</td></tr>
<tr><td>3/4</td><td>(19 Ω)</td></tr>
<tr><td>1/2</td><td>32±3 Ω</td></tr>
<tr><td>1/4</td><td>(49.5 Ω)</td></tr>
<tr><td>EMPTY</td><td>80^{+12}_{+2} Ω</td></tr>
<tr><td>3</td><td>Defective monitor panel</td><td colspan="3">If the wiring harness and fuel level sensor are normal, the monitor panel is defective.</td></tr>
</table>

Relative circuit diagram (PC40, 50MR-2)



9JF01528



9JF01385

2) The pointer of the gauge does not move from F on the panel

PC27, 30, 35MR-2

Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from F on the panel.
Relative information	• Check that the fuel level is normal. • Refer to troubleshooting M-1, too.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting		
	1	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors M2 and F15. 3) Connect T-adapter to M2 (female) and F15 (female).		
			Wiring harness between F15 (female) (7) and M2 (female) (1)	Resistance	Min. 1 M Ω
	2	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M2. 3) Connect T-adapter to M2 (male).		
			M2 (male)	Position of float	Resistance ( ) is reference value.
			Between (1) and (2)	FULL	$10^{+1.0}_{-0.5}$ Ω
				3/4	(19 Ω)
				1/2	32±3 Ω
				1/4	(49.5 Ω)
				EMPTY	80^{+12}_{+2} Ω
	3	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

PC40, 50MR-2

Failure information	• When the starting switch is turned ON, the pointer of the gauge does not move from F on the panel.
Relative information	• Check that the fuel level is normal. • Refer to troubleshooting M-1, too.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting		
	1	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors M6 and F15. 3) Connect T-adapter to M6 (female) and F15 (female).		
			Wiring harness between F15 (female) (7) and M6 (female) (1)	Resistance	Min. 1 M Ω
	2	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M6. 3) Connect T-adapter to M6 (male).		
			M6 (male)	Position of float	Resistance ( ) is reference value.
			Between (1) and (2)	FULL	$10^{+1.0}_{-0.5}$ Ω
				3/4	(19 Ω)
				1/2	32±3 Ω
				1/4	(49.5 Ω)
				EMPTY	80^{+12}_{+2} Ω
	3	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

3) Fuel level indicated by gauge is very different from actual oil level

PC27, 30, 35MR-2

Failure information	• When the starting switch is turned ON, the fuel level indicated by the gauge is very different from the actual temperature.
Relative information	• Check that the fuel level is normal. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M2. 3) Connect T-adapter to M2 (male).		
			M2 (male)	Position of float	Resistance ( ) is reference value.
			Between (1) and (2)	FULL	$10^{+1.0}_{-0.5}$ Ω
				3/4	(19 Ω)
				1/2	32±3 Ω
				1/4	(49.5 Ω)
				EMPTY	80^{+12}_{+2} Ω
	2	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

PC40, 50MR-2

Failure information	• When the starting switch is turned ON, the fuel level indicated by the gauge is very different from the actual temperature.
Relative information	• Check that the fuel level is normal. • Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M6. 3) Connect T-adapter to M6 (male).		
			M6 (male)	Position of float	Resistance ( ) is reference value.
			Between (1) and (2)	FULL	$10^{+1.0}_{-0.5}$ Ω
				3/4	(19 Ω)
				1/2	32±3 Ω
				1/4	(49.5 Ω)
				EMPTY	80^{+12}_{+2} Ω
	2	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram and panel gauges, see 1).

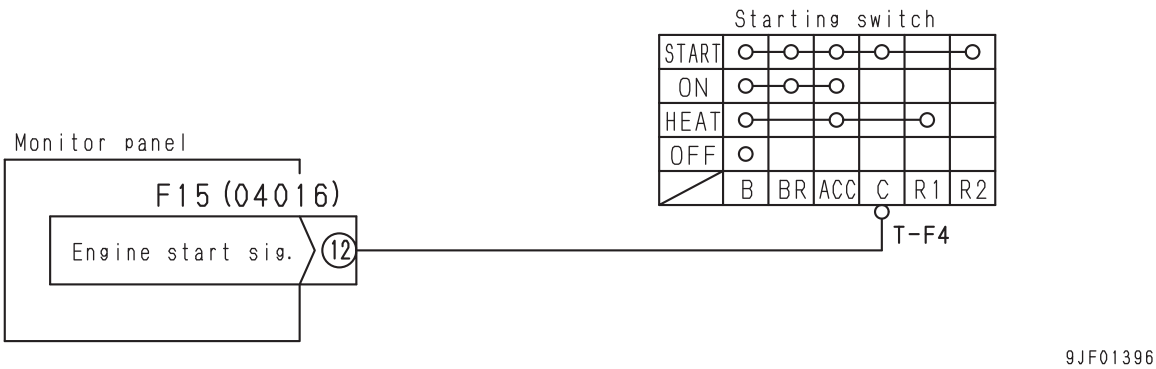
M-9 SERVICE METER DOES NOT OPERATE WHILE ENGINE IS RUNNING

1) Engine oil pressure caution is turned ON

Failure information	• Service meter (Operating hour integrator) does not operate while engine is running	Engine oil pressure caution is turned ON
Relative information	• While the engine is running, the service meter operates even if the machine does not move at all. • While the engine is stopped, the service meter does not operate. • Refer to troubleshooting M-1, too. ★ Carry out troubleshooting "M-4 Engine oil pressure caution is turned ON" first, then carry out the following troubleshooting.	

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to F15 (female). 4) Turn starting switch to START (Do not hold for long time, however).		
			Between T-F4 and ground	Voltage	10 – 15 V
			Between F15 (female) (12) and ground	Voltage	10 – 15 V
	2	Defective monitor panel	If the wiring harness is normal, the monitor panel is defective.		

Relative circuit diagram



2) Charge warning is displayed, too

Failure information	• Service meter (Operating hour integrator) does not operate while engine is running	Charge warning is displayed, too
Relative information	• While the engine is running, the service meter operates even if the machine does not move at all. • While the engine is stopped, the service meter does not operate. • Refer to troubleshooting M-1, too. ★ Carry out the troubleshooting for "M-5 Charge warning is displayed" first, then carry out the following troubleshooting.	

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to F15 (female). 4) Turn starting switch to START (Do not hold for long time, however).		
			Between T-F4 and ground	Voltage	10 – 15 V
			Between F15 (female) (12) and ground	Voltage	10 – 15 V
	2	Defective monitor panel	If the wiring harness is normal, the monitor panel is defective.		

★ For the related circuit diagram, see 1).

3) Engine oil pressure and charge does not warning

Failure information	• Service meter (Operating hour integrator) does not operate while engine is running	Engine oil pressure and charge does not warning
Relative information	• While the engine is running, the service meter operates even if the machine does not move at all. • While the engine is stopped, the service meter does not operate. • Refer to troubleshooting M-1, too. ★ If the service meter still does not work after the troubleshooting for M-4 and M-5, the possible cause is as follows.	

		Cause	Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	2	Defective monitor panel	If any abnormality is not detected by 1) and 2), the monitor panel is defective.

★ For the related circuit diagram, see 1).

M-10 2ND TRAVEL SPEED IS NOT SELECTED

1) Monitor panel does not respond and 2nd travel speed is not selected

Failure information	• When the 2nd travel speed selection switch is pressed while the engine is running, the monitor panel does not make the following responses. 1) Turning ON/OFF of 2nd travel speed indicator 2) Changing sound by buzzer (Short sound)
Relative information	

★ Carry out troubleshooting M-1.

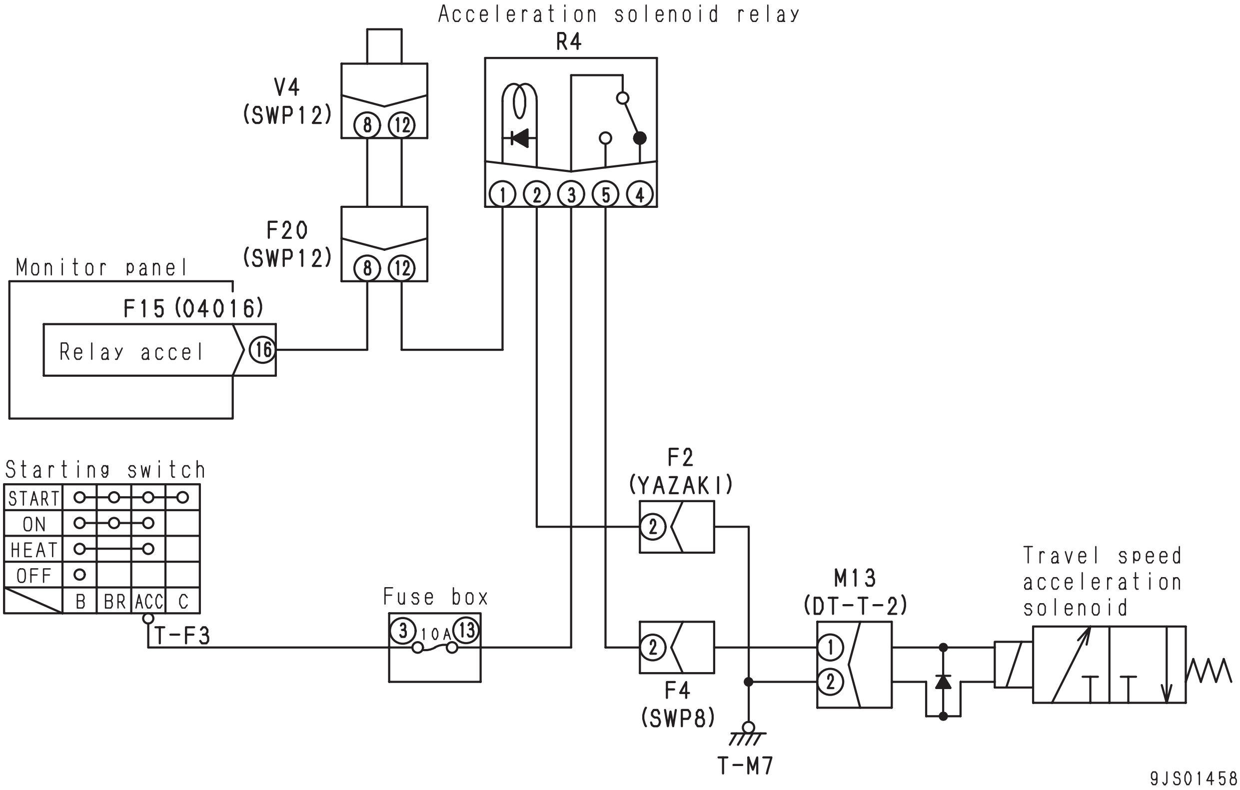
2) Monitor panel responds but 2nd travel speed is not selected

PC27, 30, 35MR-2

Failure information	• Monitor panel responds but 2nd travel speed is not selected.
Relative information	• Refer to troubleshooting M-1, too.

<table>
<tr><td rowspan="30">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse (13)</td><td colspan="4">If the fuse is burned, the circuit probably has a grounding fault.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective starting switch (Internal defective contact)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect negative (–) terminal of battery.</td></tr>
<tr><td colspan="2">Starting switch</td><td>Position</td><td>Resistance</td></tr>
<tr><td colspan="2" rowspan="2">Between terminals B and ACC</td><td>OFF</td><td>Min. 1 M Ω</td></tr>
<tr><td>ON</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="8">3</td><td rowspan="8">Defective 2nd travel speed selection relay</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connector R4.
3) Connect T-adapter to R4 (male).</td></tr>
<tr><td colspan="3">R4 (male)</td><td>Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td>86 – 106 Ω</td></tr>
<tr><td colspan="3">Between (3) and (4)</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Between (3) and (5)</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="4">1) Turn starting switch OFF.
2) Insert T-adapter in R4.
3) Turn starting switch ON.</td></tr>
<tr><td colspan="2">R4</td><td>2nd travel speed selection switch</td><td>Voltage</td></tr>
<tr><td colspan="2">Between (5) and ground</td><td>ON</td><td>10 – 15 V</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Defective 2nd travel speed selection solenoid</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect connector M13.
3) Connect T-adapter to M13 (male).</td></tr>
<tr><td rowspan="2">M13 (male)</td><td>Between (1) and (2)</td><td>Resistance</td><td>10.5 – 12 Ω</td></tr>
<tr><td>Between (1) and body</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect T-F3 and connectors F15, R4 and M13.
3) Connect T-adapter to F15, R4 and M13 (female).</td></tr>
<tr><td colspan="2">Wiring harness between T-F3 and fuse (3) or between (13) and R4 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R4 (female) (5), F4 (2) and M13 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between F15 (female) (16), F20 (8) and V4 (8) or between (12), F20 (12) and R4 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R4 (female) (2), F2 (2) and ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Short circuit with chassis ground in wiring harness (Contact with ground circuit)</td><td colspan="4">1) Turn starting switch OFF.
2) Disconnect T-F3 and connectors F15, R4 and M13.
3) Connect T-adapter to F15, R4 and M13 (female).</td></tr>
<tr><td colspan="2">Between wiring harness between fuse (13) and R4 (female) (3) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="2">Between wiring harness between R4 (female) (5), F4 (2) and M13 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
<tr><td colspan="2">Between wiring harness between F15 (female) (16), F20 (8) and V4 (8) or between (12), F20 (12) and R4 (female) (1) and ground</td><td>Resistance</td><td>Min. 1 M Ω</td></tr>
</table>

Relative circuit diagram (PC27, 30, 35MR-2)

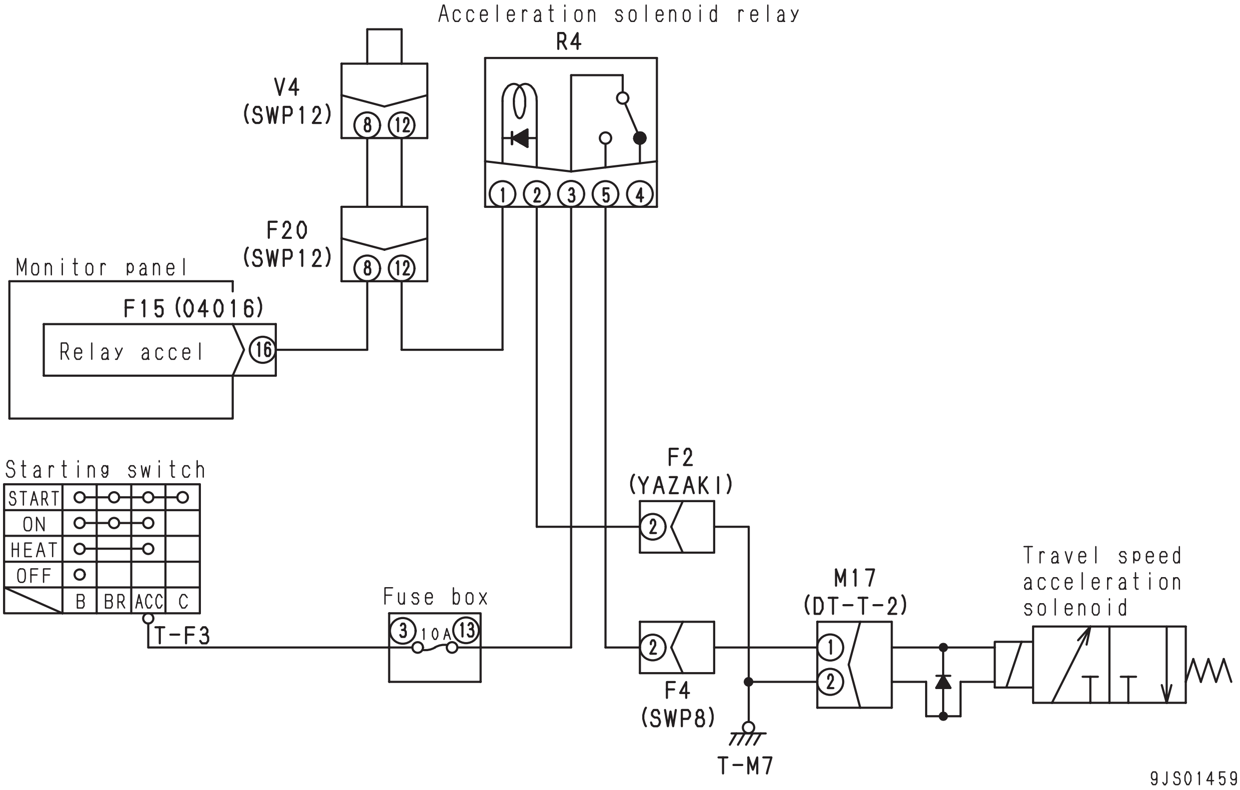


PC40, 50MR-2

Failure information	• Monitor panel responds but 2nd travel speed is not selected.
Relative information	• Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fuse (13)	If the fuse is burned, the circuit probably has a grounding fault.		
	2	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.		
			Starting switch	Position	Resistance
			Between terminals B and ACC	OFF	Min. 1 M Ω
				ON	Max. 1 Ω
	3	Defective 2nd travel speed selection relay	1) Turn starting switch OFF. 2) Disconnect connector R4. 3) Connect T-adapter to R4 (male).		
			R4 (male)		Resistance
			Between (1) and (2)		86 – 106 Ω
			Between (3) and (4)		Max. 1 Ω
			Between (3) and (5)		Min. 1 M Ω
			1) Turn starting switch OFF. 2) Insert T-adapter in R4. 3) Turn starting switch ON.		
			R4	2nd travel speed selection switch	Voltage
			Between (5) and ground	ON	10 – 15 V
	4	Defective 2nd travel speed selection solenoid	1) Turn starting switch OFF. 2) Disconnect connector M17. 3) Connect T-adapter to M17 (male).		
			M17 (male) Between (1) and (2)	Resistance	10.5 – 12 Ω
			M17 (male) Between (1) and body	Resistance	Min. 1 M Ω
	5	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect T-F3 and connectors F15, R4 and M17. 3) Connect T-adapter to F15, R4 and M17 (female).		
			Wiring harness between T-F3 and fuse (3) or between (13) and R4 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between R4 (female) (5), F4 (2) and M17 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (16), F20 (8) and V4 (8) or between (12), F20 (12) and R4 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R4 (female) (2), F2 (2) and ground	Resistance	Max. 1 Ω
	6	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect T-F3 and connectors F15, R4 and M17. 3) Connect T-adapter to F15, R4 and M17 (female).		
			Between wiring harness between fuse (13) and R4 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R4 (female) (5), F4 (2) and M17 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between F15 (female) (16), F20 (8) and V4 (8) or between (12), F20 (12) and R4 (female) (1) and ground	Resistance	Min. 1 M Ω

Relative circuit diagram (PC40, 50MR-2)



M-11 WORKING LAMP DOES NOT LIGHT UP

1) Monitor panel does not respond and working lamp does not light up

Failure information	• When the starting switch is turned ON and the lamp switch is pressed, the monitor panel does not make the following responses. 1) Turning ON/OFF of monitor back light 2) Changing sound by buzzer (Short sound)
Relative information	

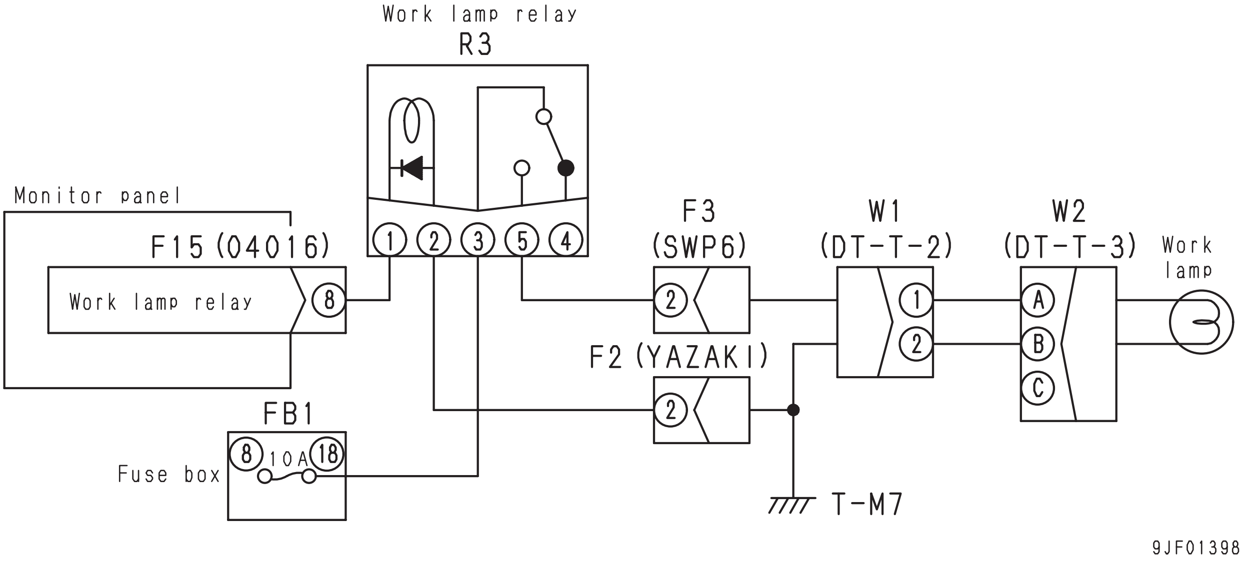
★ Carry out troubleshooting M-1.

2) Monitor panel responds but working lamp does not light up

Failure information	• Monitor panel responds but 2nd travel speed is not selected.
Relative information	• Refer to troubleshooting M-1, too.

		Cause	Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective fuse (18)	If the fuse is burned, the circuit probably has a grounding fault.		
	2	Defective lamp	1) Turn starting switch OFF. 2) Disconnect connector W2. 3) Connect T-adapter to W2 (female). 4) Turn starting switch ON. 5) Turn lamp switch ON.		
			Between W2 (female) and ground	Voltage	10 – 15 V
	3	Defective lamp relay	1) Turn starting switch OFF. 2) Disconnect relay R3. 3) Connect T-adapter to R3 (male).		
			R3 (male)	Resistance	
			Between (1) and (2)	86 – 106 Ω	
			Between (3) and (4)	Max. 1 Ω	
			Between (3) and (5)	Min. 1 M Ω	
			1) Turn starting switch OFF. 2) Insert T-adapter in relay R3. 3) Turn starting switch ON. 4) Turn lamp switch ON.		
			Between R3 (5) and ground	Voltage	10 – 15 V
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors F15, R3 and W2. 3) Connect T-adapter F15, R3 and W2 (female).		
			Wiring harness between fuse (18) and R3 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (8) and R3 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R3 (female) (5), F3 (2), W1 (1) and W2 (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between R3 (female) (2), F2 (2) and ground	Resistance	Max. 1 Ω
			Wiring harness between W2 (female) (B), W1 (2) and ground	Resistance	Max. 1 Ω
	5	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors F15, R3 and W2. 3) Connect T-adapters to F15, R3 and W2 (female).		
			Between wiring harness between fuse (18) and R3 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between F15 (female) (8) and R3 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R3 (female) (5), F3 (2), W1 (1) and W2 (female) (A) and ground	Resistance	Min. 1 M Ω
	6	Defective monitor panel	1) Turn starting switch OFF. 2) Insert T-adapter in F15. 3) Turn starting switch ON. 4) Turn lamp switch ON.		
			Between F15 (8) and ground	Voltage	10 – 15 V

Relative circuit diagram



TROUBLESHOOTING OF ENGINE (S-MODE)

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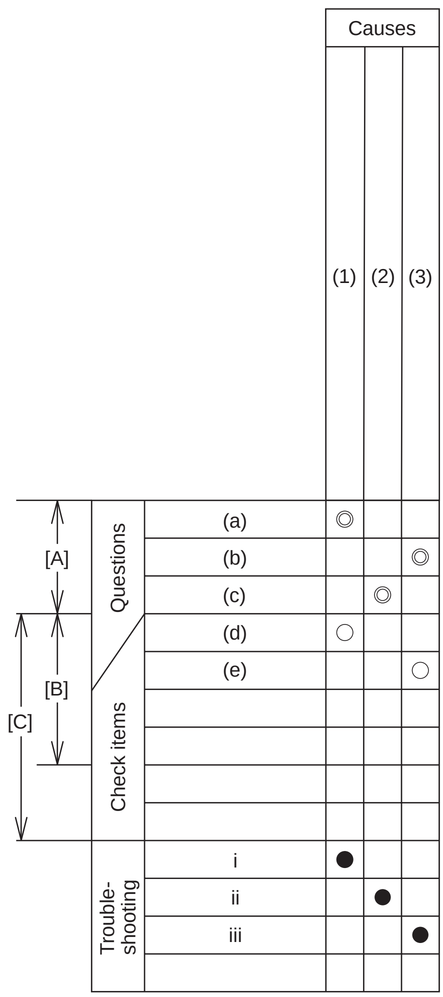
METHOD OF USING TROUBLESHOOTING CHARTS

This troubleshooting chart is divided into three sections: **questions**, **check items**, **and troubleshooting**. The questions and check items are used to pinpoint high probability causes that can be located from the failure symptoms or simple inspeciton without using troubleshooting tools.
Next, troubleshooting tools or direct inspection are used to check the high probability causes to make final confirmation.

[Questions]
Sections [A] + [B] in the chart on the right corresponds to the items where answers can be obtained from the user. The items in [B] are items that can be obtained from the user, depending on the user's level.
[Check items]
The serviceman carries out simple inspection to narrow down the causes. The items under [C] in the chart on the right correspond to this.
The serviceman narrows down the causes from information [A] that he has obtained from the user and the results of [C] that he has obtained from his own inspection.
[Troubleshooting]
Troubleshooting is carried out in the order of probability, starting with the causes that have been marked as having the highest probability from information gained from **[Questions]** and **[Check items]**.



The basic method of using the troubleshooting chart is as follows.
Items listed for **[Questions]** and **[Check items]** that have a relationship with the Cause items are marked with ○, and of these, causes that have a high probability are marked with ◎.
Check each of the **[Questions]** and **[Check items]** in turn, and marked the ○ or ◎ in the chart for items where the problem appeared. The vertical column (Causes) that has the highest number of points is the most probable cause, so start troubleshooting for that item to make final confirmation of the cause.

*1. For [Confirm recent repair history] in the **[Questions]** Section, ask the user, and mark the Cause column with △ to use as reference for locating the cause of the fairure. However, do not use this when making caluculations to narrow down the causes.

*2. Use the △ in the Cause column as reference for [Degree of use (Operated for long period)] in the **[Questions]** section as reference. As a rule, do not use it when calculating the points for locating the cause, but it can be included if necessary to determine the order for troubleshooting.

			Causes: Seized turbocherger, interference	Clogged air cleaner element	Worn piston ring, cylinder	Clogged, seized injection nozzle	Improper injection timing	Defective injection pump (excessive injection)	
*1	Confirm recent repair history								
*2	Degree of use	Operated for long period		△	△	△			

- **Example of troubleshooting when exhaust gas is black**
  Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is red].
  If we look from these three symptoms to find the causes, we find that there is a relationship with five causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.

S-7 EXHAUST GAS IS BLACK (INCOMPLETE COMBUSTION)

General causes why exhaust gas is black
- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Clogged air cleaner element	Worn piston ring, cylinder	Clogged injection nozzle, defective spray	Improper injection timing	Defective injection pump (excessive injection)	Improper valve clearance	Crushed, clogged muffler	Defective contact of valve and valve seat	Deffective injection pump (rack, plunger seized)
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△	△	△					△	
	Color of exhaust gas	Suddenly became black			○						○
		Gradually became black	◎		○						
		Blue under light load		◎							
	Engine oil must be added more frequently			◎							
	Power was lost	Suddenly			○				○		○
		Gradually	○	○						○	
	Non-specified fuel has been used				○						○
	Dust indicator lights up		◎								
Check items	Blow-by gas is excessive			◎							
	Engine pickup is poor and combustion is irregular				◎			○	○		○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low				◎						○
	Timing lock on fuel injection pump does not match					◎					
	Seal on injection pump has come off						◎				
	Clanging sound is heard from around cylinder head							◎			
	Exhaust noise is abnormal				○				◎		
	Muffler is crushed								◎		
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●								
	When compression pressure is measured, it is found to be low			●						●	
	Speed does not change when operation of certain cylinders is stopped				●						
	Injection pump test shows that injection amount is incorrect						●				
	When valve clearance is checked directly it is found to be outside standard value							●			
	When muffler is removed, exhaust color returns to normal								●		
	When control rack is pushed, it is found to be heavy, or does not return										●
		Remedy	Clean	Replace	Replace	Adjust	Adjust	Adjust	Replace	Replace	Replace

Five causes

Step1

Clarify the relationship between the three symptoms in the [Questions] and [Check items] section and the five Cause items in the vertical column.

Three symptoms

Step2

Add up the total of ○ and ◎ marks where the horizontal lines for the three symptoms and the vertical columns for the causes intersect.

(1) Clogged air cleaner element: ◎○◎
(2) Air leakage between turbocharger and cylinder head: ○○
(3) Clogged, seized fuel injection nozzle: ○
(4) Defective contact of valve, valve seat: ○
(5) Worn piston ring, cylinder: ○

Step3

The calculation in Step 2 show that the closest relationship is with [Clogged air cleaner element]. Follow this column down to the troubleshooting area and carry out the troubleshooting item marked ●. The Remedy is given as [Clean], so carry out cleaning, and the exhaust gas color should return to normal.

S-1 STARTING PERFORMANCE IS POOR (STARTING ALWAYS TAKES TIME)

General causes why exhaust smoke comes out but engine takes time to start

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
  (At ambient temperature of – 10°C or below, ASTM D975 No. 2 diesel fuel is used)

★ Battery charging rate

Ambient temperature \ Charging rate	100 %	90 %	80 %	75 %	70 %
20°C	1.28	1.26	1.24	1.23	1.22
0°C	1.29	1.27	1.25	1.24	1.23
– 10°C	1.30	1.28	1.26	1.25	1.24

- The specific gravity should exceed the value for the charging rate of 70% in the above table.
- In cold areas the specific gravity must exceed the value for the charging rate of 75% in the above table.

			Causes									
			Worn piston ring, cylinder	Defective contact of valve, valve seat	Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Starting aid: Intake air heater	Defective regulator	Defective alternator	Defective or deteriorated battery	Defective injection nozzle
Questions	Confirm recent repair history											
Questions	Degree of use of machine	Operated for long period			△	△	△				△	
Questions	Ease of starting	Gradually became worse	◎	◎	○	○	○					
Questions	Ease of starting	Starts when warm						◎			◎	
Questions	Preheating indicator lamp does not light up							◎				
Questions	Engine oil must be added more frequently		◎									
Questions	Replacement of filters has not been carried out according to operation Manual				◎	◎	◎					○
Questions	Non-specified fuel has being used					○	○					○
Check items	Air cleaner clogging monitor lights up				◎							
Check items	Battery charging lamp lights up								◎	◎		
Check items	Starting motor cranks engine slowly										◎	
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎
Check items	Engine does not pick up smoothly, and combustion is irregular		○	○								◎
Check items	Blow-by gas is excessive		◎									
Check items	Timing lock on fuel injection pump does not match											
Check items	Mud is stuck to fuel tank cap											
Check items	When engine is cranked with starting motor,	1) Little fuel comes out even when injection pump piping sleeve nut is loosened										
Check items		2) Little fuel comes out even when fuel filter air bleed plug is loosened				◎	◎					
Check items	Leakage from fuel piping											
Check items	There is hunting from engine (rotation is irregular)					○	○					
Troubleshooting	When compression pressure is measured, it is found to be low		●	●								
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged				●							
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged					●						
Troubleshooting	When feed pump gauze filter is inspected directly, it is found to be clogged						●					
Troubleshooting	Heater mount does not become warm							●				
Troubleshooting	Is voltage 13.5–14.5V between alternator terminal B and terminal E with engine at low idle?	Yes							●			
Troubleshooting		No								●		
Troubleshooting	Either specific gravity of electrolyte or voltage of battery is low										●	
Troubleshooting	Speed does not change when operation of certain cylinders is stopped											●
Troubleshooting	When control rack is pushed, it is found to be heavy or does not return (When rear cover of pump is removed, plunger control sleeve does not move)											
Troubleshooting	When fuel tank cap is inspected directly, it is found to be clogged											
	Remedy		Replace	Correct	Clean	Clean	Clean	Replace	Replace	Replace	Replace	Replace

* Use a test stand when adjusting.

Causes			
Defetive injection timing	Defetive injection pump (rack, plunger stuck)	Leakage, clogging, air in fuel piping	Clogged air breather hole in fuel tank
	○		
	○		
◎			
			○
	◎		
	◎		
	○	◎	
		◎	○
		●	
	●		
			●
* Adjust	Replace	Correct	Clean

S-2 ENGINE DOES NOT START

(1) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
  ★ If internal parts of the engine are seized, carry out troubleshooting for "S-4 Engine stops during operations".
- Defective electrical system

			Causes: Defective wiring of starting circuit	Defective or deteriorated battery	Defective starting motor	Broken ring gear	Defective safety relay	Defective battery terminal connection	Defective fuel cut-off solenoid	Defective starting switch
Questions	Confirm recent repair history									
Questions	Degree of use of machine	Operated for long period		△		△				
Questions	Condition of horn when starting switch is turned ON	Horn sounds	◎					○		○
Questions	Condition of horn when starting switch is turned ON	Horn volume is low		◎						
Questions / Check items	When starting switch is turned to START, pinion moves out, but	Speed of rotation is low		◎						
Questions / Check items	When starting switch is turned to START, pinion moves out, but	Makes grating noise			◎	◎				
Questions / Check items	When starting switch is turned to START, pinion moves out, but	Soon disengages pinion again					◎			
Questions / Check items	When starting switch is turned to START, pinion moves out, but	Makes rattling noise and does not turn		○	○		○			
Check items	When starting switch is turned to START, pinion does not move out		◎	○						○
Check items	When starting switch is turned to ON, there is no clicking sound		Troubleshooting of E-1 defective wiring in starting circuit	○						
Check items	Battery terminal is loose							◎		
Check items	When starting switch is turned ON, linkage does not operate								◎	
Check items	When battery is checked, battery electrolyte is found to be low			◎						
Troubleshooting	Specific gravity of electrolyte, voltage of battery is low			●						
Troubleshooting	For the following conditions 1) - 3), turn the starting switch OFF, connect the cord, and carry out troubleshooting 1) When terminal B and terminal C of starting switch are connected, engine starts									●
Troubleshooting	2) When terminal B and terminal S of starting motor are connected, engine starts				●					
Troubleshooting	3) When terminals between CN-RN5 (female) (1) and (2) are connected, engine starts						●			
Troubleshooting	When ring gear is inspected directly, tooth surface is found to be chipped					●				
Troubleshooting	When fuel cut-off solenoid linkage is disconnected, engine does not start								●	
		Remedy	—	Replace	Replace	Replace	Replace	Replace	Replace	Replace

(2) Engine turns but no exhaust smoke comes out (Fuel is not being injected)

General causes why engine turns but no exhaust smoke comes out

- Supply of fuel impossible
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

★ Standards for use of fuel

KIND OF FLUID	AMBIENT TEMPRATURE									
	-22 -30	-4 -20	14 -10	32 0	50 10	68 20	86 30	104 40	122°F 50°C
Diesel fuel	*1 (-22 to 14°F / -30 to -10°C)		ASTM D975 No.2 (14 to 104°F / -10 to 40°C)						

*1: ASTM D975 No.1

		Broken injection pump drive shaft, key	Defective injection pump (rack, plunger seized)	Seized, broken feed pump piston	Clogged fuel filter, strainer	Clogged feed pump gouze filter	Insufficient fuel in tank	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank	Defective fuel cut-off solenoid	Improper fuel used
Questions	Confirm recent repair history										
Questions	Degree of use of machine: Operated for long period				△	△		△			
Questions	Exhaust smoke suddenly stops coming out (when starting again)	◎	◎	◎							
Questions	Replacement of filters has not been carried out according to Operation Manual				◎	◎					
Check items	Fuel tank is found to be empty						◎				
Check items	There is leakage from fuel piping							◎			
Check items	Mud is stuck to fuel tank cap								◎		
Check items	When starting switch is turned ON, linkage does not operate									◎	
Check items	When fuel filter is drained, fuel does not come out										◎
Check items	When engine is cranked with starting motor, 1) No fuel comes out even when fuel filter air bleed plug is loosened	◎			○	○					○
Check items	2) No fuel spurts out even when injection pump piping sleeve nut is loosened	◎	◎	◎							
Check items	Rust and water are found when fuel tank is drained				○	○					
Troubleshooting	Inspect injection pump directly	●									
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return		●								
Troubleshooting	Inspect feed pump directly			●							
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged				●						●
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged					●					
Troubleshooting	When fuel cap is inspected directly, it is found to be clogged								●		
Troubleshooting	When fuel cut-off solenoid linkage is disconnected, engine does not start									●	
	Remedy	Replace	Replace	Replace	Clean	Clean	Add	Repair	Repair	Replace	Replace

(3) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine does not start

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fluel

			Causes: Defective, broken valve system (valve, rocker lever, etc.)	Defective injection pump (rack, plunger stuck)	Worn piston ring, cylinder liner	Clogged fuel filter, strainer	Clogged feed pump gouze filter	Clogged air cleaner element	Starting aid: Intake air heater	Defective or deteriorated battery	Leakage, clogging, air in fuel system	Clogged injection nozzle, defective spray	Clogged air breather hole in fuel tank cap	Improper fuel used
Questions	Confirm recent repair history													
Questions	Degree of use of machine	Operated for long period			△	△	△					△		
Questions	Suddenly failed to start		◎	◎										
Questions	When engine is cranked, abnormal noise is heard from around cylinder head		◎											
Questions	Engine oil must be added more frequently				◎									
Questions	Non-specified fuel is being used			○								○		
Questions	Replacement of filters has not been carried out according to Operation Manual					◎	◎	◎						
Check items	Rust and water are found when fuel tank is drained					◎	◎							
Check items	Dust indicator lights up							◎						
Check items	Preheating indicator lamp does not light up								◎					
Check items	Starting motor cranks engine slowly									◎				
Check items	Mud is stuck to fuel tank cap												○	
Check items	When fuel lever is placed at FULL position, it does not contact stopper			○										
Check items	When engine is cranked with starting motor, 1) Little fuel comes out even when injection pump piping sleeve nut is loosened			◎										
Check items	2) Little fuel comes out even when fuel filter air bleed plug is loosened					◎	◎							○
Check items	There is leakage from fuel piping										◎			
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎		
Check items	When fuel filter is drained, no fuel comes out													◎
Troubleshooting	Remove head cover and check directly		●											
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return			●										
Troubleshooting	When compression pressure is measured, it is found to be low				●									
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged					●								●
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged						●							
Troubleshooting	When air cleaner is inspected directly, it is found to be clogged							●						
Troubleshooting	Heater mount does not become warm								●					
Troubleshooting	Either specific gravity of electrolyte or voltage of battery is low									●				
Troubleshooting	When feed pump is operated, there is no response, or operation is too heavy										●			
Troubleshooting	Speed does not change when operation of certain cylinders is stopped											●		
Troubleshooting	When fuel tank cap is inspected directly, it is found to be clogged												●	
	Remedy		Replace	Replace	Replace	Clean	Clean	Clean	Correct	Replace	Correct	Clean	Clean	Replace

S-3 ENGINE DOES NOT PICK UP SMOOTHLY (FOLLOW-UP IS POOR)

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injction
- Improper fuel used

			Causes									
			Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump gouze filter	Clogged injection nozzle, defective spray	Seized injection pump plunger	Worn piston ring, cylinder liner	Improper valve clearance	Clogged air breather hole in fuel tank cap	Clogged, leaking fuel piping	Defective contact of valve and valve seat
Questions	Confirm recent repair history											
Questions	Degree of use of machine	Operated for long period	△	△	△			△				△
Questions	Replacement of filters has not been carried out according to Operation Manual		◎	◎	◎							
Questions	Non-specified fuel is being used			◎	◎	◎	◎					
Questions	Engine oil must be added more frequently							◎				
Questions	Rust and water are found when fuel tank is drained			◎	◎							
Check items	Dust indicator lights up		◎									
Check items	Engine pick-up suddenly became poor					○				○	○	
Check items	Color of exhaust gas	Blue under light load				○		◎				
Check items	Color of exhaust gas	Black	◎			◎						○
Check items	Clanging sound is heard from around cylinder head								◎			
Check items	Mud is stuck to fuel tank cap									◎		
Check items	There is leakage from fuel piping										◎	
Check items	High idle speed under no load is normal, but speed suddenly drops when load is applied			◎	◎					○		
Check items	There is hunting from engine (rotation is irregular)			○	◎	○				○		
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low					◎	○					
Check items	Blow-by gas is excessive							◎				
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●									
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged			●								
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged				●							
Troubleshooting	Speed does not change when operation of certain cylinders is stopped					●						
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return						●					
Troubleshooting	When compression pressure is measured, it is found to be low							●				●
Troubleshooting	When valve clearance is checked directly, it is found to be outside standard value								●			
Troubleshooting	When fuel tank cap is inspected directly, it is found to be clogged									●		
Troubleshooting	When feed pump is operated, operation is too light or too heavy										●	
	Remedy		Clean	Clean	Clean	Correct	Replace	Replace	Adjust	Clean	Correct	Replace

S-4 ENGINE STOPS DURING OPERATIONS

General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating
  ★ If there is overheating and the engine stops, carry out troubleshooting for "S-14 Coolant temperature becomes too high (Overheating)".

			Causes: Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken dynamic valve system (valve, rocker lever, etc.)	Broken, seized gear train	Broken pump auxiliary equipment	Broken fuel pump drive shaft, key	Insufficient fuel in tank	Clogged fuel filter, strainer	Clogged feed pump gouze filter	Broken, seized feed pump piston	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank	Defective injection pump (rack, plunger stuck)
Questions	Confirm recent repair history														
Questions	Degree of use of machine	Operated for long period								△	△				
Questions	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎	◎	◎				○			○
Questions	Condition when engine stopped	Engine overheated and stopped	◎	○			○								
Questions	Condition when engine stopped	Engine stopped slowly							◎	○	○				
Questions	Condition when engine stopped	There was hunting and engine stopped							◎	○	○	○		○	
Questions	Replacement of filters has not been carried out according to Operation Manual									◎	◎				
Questions	Non-specified fuel is being used									○	○	○			○
Check items	Fuel level caution lamp lights up								◎						
Check items	Fuel tank is found to be empty								◎						
Check items	When feed pump is operated, operation is too light or too heavy									○	○		◎		
Check items	Mud is stuck to fuel tank cap													◎	
Check items	When it is attempted to turn by hand using barring tool	Does not turn at all	◎	◎											
Check items	When it is attempted to turn by hand using barring tool	Turns in opposite direction			◎										
Check items	When it is attempted to turn by hand using barring tool	Moves amount of backlash				◎	◎								
Check items	When it is attempted to turn by hand using barring tool	Shaft does not turn						◎							
Check items	Rust and water are found when fuel tank is drained									◎	◎				
Check items	Metal particles are found when oil is drained		◎	◎							○	○			
Troubleshooting	Remove oil pan and inspect directly		●	●											
Troubleshooting	Remove head cover and inspect directly				●										
Troubleshooting	When gear train is inspected, it does not turn					●									
Troubleshooting	Rotates when pump auxiliary equipment is removed						●								
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged									●					
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged										●				
Troubleshooting	Inspect feed pump directly											●			
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return														●
		Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Add	Clean	Clean	Replace	Correct	Clean	Replace

S-5 ENGINE DOES NOT ROTATE SMOOTHLY (HUNTING)

General causes why engine does not rotate smoothly

- Air in fuel system
- Defective governor mechanism

			Defective operation of governor	Defective adjustment of governor	Defective operation of control rack	Low idle speed is too low	Insufficient fuel in tank	Clogged feed pump gouze filter	Clogged fuel filter, strainer	Clogged, air in circuit between fuel tank and feed pump	Clogged, air in circuit between feed pump and nozzle	Clogged air breather hole in fuel tank
Questions	Confirm recent repair history											
Questions	Degree of use of machine	Operated for long period						△	△			
Questions	Condition of hunting	Occurs at a certain speed range	◎	◎	◎	○						
Questions	Condition of hunting	Occurs at low idle	○			◎		○	○	○	○	
Questions	Condition of hunting	Occurs even when speed is raised	○	○	○							○
Questions	Condition of hunting	Occurs on slopes					◎					
Questions	Replacement of filters has not been carried out according to Operation Manual							◎	◎			
Check items	Fuel tank is found to be empty						◎					
Check items	Rust, water are found when fuel tank is drained							○	○			
Check items	Leakage from fuel piping									◎	◎	
Check items	When feed pump is operated,											
Check items	1) No response, light, return is quick									◎	◎	
Check items	2) No response, light, return is normal									◎		
Check items	Engine speed sometimes rises too far		◎	◎								
Check items	Engine is sometimes difficult to stop		◎		◎							
Check items	Seal on injection pump has come off			◎		◎						
Troubleshooting	When governor lever is moved it is found to be stiff		●		●							
Troubleshooting	When injection pump is tested, governor is found to be improperly adjusted			●								
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return				●							
Troubleshooting	When fuel tank cap is inspected directly, it is found to be clogged					●						●
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged							●				
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged								●			
	Remedy		Adjust	Adjust	Adjust	Adjust	Add	Clean	Clean	Correct	Correct	Clean

S-6 ENGINE LACKS OUTPUT OR LACKS POWER

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
  (if non-specified fuel is used, output drops)
- Lack of output due to overheating
  ★ If there is overheating and lack of output, carry out troubleshooting for "S-14 Coolant temperature becomes too high (Overheating)".

			Causes											
			Clogged air cleaner element	Worn piston ring, cylinder	Clogged fuel filter, strainer	Clogged feed pump gouze filter	Clogged injection nozzle, defective spray	Seized injection pump plunger	Improper injection timing	Improper valve clearance	Defective contact of valve and valve seat	Bent fuel lever linkage, defective adjustment	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank
Questions	Confirm recent repair history													
Questions	Degree of use of machine	Operated for long period	△	△	△	△					△			
Questions	Power was lost	Suddenly												
Questions	Power was lost	Gradually	○	○	○	○	○				○			
Questions	Engine oil must be added more frequently			◎										
Questions	Replacement of filters has not been carried out according to Operation Manual		◎		◎	◎								
Questions	Non-specified fuel is being used				◎	◎	◎	◎						
Questions	Dust indicator lights up		◎											
Questions / Check items	Color of exhaust gas	Black	◎											
Questions / Check items	Color of exhaust gas	Blue under light load		◎										
Check items	Blow-by gas is excessive			◎										
Check items	Engine pickup is poor and combustion is irregular						○						○	○
Check items	Match marks of fuel injection pump are shifted								◎					
Check items	High idle speed under no load is normal, but speed suddenly drops when load is applied				◎	◎								○
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low						◎	○						
Check items	There is hunting from engine (rotation is irregular)				○	○							○	○
Check items	Clanging sound is heard from around cylinder head									◎				
Check items	High idle speed of engine is low							○				◎		
Check items	Leakage from fuel piping												◎	
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●											
Troubleshooting	When compression pressure is measured, it is found to be low			●							●			
Troubleshooting	When fuel filter, strainer are inspected directly, they are found to be clogged				●									
Troubleshooting	When feed pump gouze filter is inspected directly, it is found to be clogged					●								
Troubleshooting	Speed does not change when operation of certain cylinders is stopped						●							
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return							●						
Troubleshooting	When valve clearance is checked directly, it is found to be outside standard value									●				
Troubleshooting	When fuel dial is placed at FULL position, lever does not contact stopper											●		
Troubleshooting	When feed pump is operated, operation is too light or too heavy												●	
Troubleshooting	When fuel tank cap is inspected directly, it is found to be clogged													●
	Remedy		Clean	Replace	Clean	Clean	Correct	Replace	Adjust	Adjust	Replace	Adjust	Correct	Clean

S-7 EXHAUST SMOKE IS BLACK (INCOMPLETE COMBUSTION)

General causes why exhaust smoke is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

			Causes: Clogged air cleaner element	Worn piston ring, cylinder	Clogged injection nozzle, defective spray	Improper injection timing	Defective injection pump (excessive injection)	Improper valve clearance	Crushed, clogged muffler	Defective contact of valve and valve seat	Defective injection pump (rack, plunger seized)
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△	△	△					△	
	Color of exhaust gas	Suddenly became black			○						○
		Gradually became black	◎		○						
		Blue under light load		◎							
	Engine oil must be added more frequently			◎							
	Power was lost	Suddenly			○				○		○
		Gradually	○	○						○	
	Non-specified fuel is being used				○						○
Check items	Dust indicator lights up		◎								
	Blow-by gas is excessive			◎							
	Engine pickup is poor and combustion is irregular				◎			○	○		○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low				◎						○
	Timing lock on fuel injection pump does not match					◎					
	Seal on injection pump has come off						◎				
	Clanging sound is heard from around cylinder head							◎			
	Exhaust noise is abnormal				○				◎		
	Muffler is crushed								◎		
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●								
	When compression pressure is measured, it is found to be low			●						●	
	Speed does not change when operation of certain cylinders is stopped				●						
	Injection pump test shows that injection amount is incorrect						●				
	When valve clearance is checked directly it is found to be outside standard value							●			
	When muffler is removed, exhaust color returns to normal								●		
	When control rack is pushed, it is found to be heavy, or does not return										●
		Remedy	Clean	Replace	Replace	Adjust	Adjust	Adjust	Replace	Replace	Replace

S-8 OIL CONSUMPTION IS EXCESSIVE OR EXHAUST SMOKE IS BLUE

★ Do not run the engine at idle for more than 20 minutes continuously. (Both low and high idle)

General causes why oil consumption is excessive

- Abnormal combustion of oil
- External leakage of oil
- Wear of lubrication system

* The oil coolers are installed to only turbocharged engines.

			Causes: Broken piston ring	Worn piston ring, cylinder	Clogged breather or breather hose	Leakage from oil filter or oil cooler	Leakage from oil piping	Leakage from oil drain plug	Leakage from oil pan or cylinder head	Broken oil cooler	Worn, broken rear seal, seal surface	Dust sucked in from intake system	Worn valve (stem, guide), broken seal
Questions	Confirm recent repair history												
Questions	Degree of use of machine	Operated for long period		△									△
Questions	Oil consumption suddenly increased		◎							○			
Questions	Engine oil must be added more frequently			◎						○			
Questions	Engine oil becomes contaminated quickly		○	◎	○								
Questions	Exhaust smoke is blue under light load		◎	◎									
Questions / Check items	Amount of blow-by gas	Excessive	◎	◎									○
Questions / Check items	Amount of blow-by gas	None			◎								
Check items	Area around engine is dirty with oil					◎	◎	◎	◎				
Check items	There is oil in engine coolant									◎			
Check items	When exhaust pipe is removed, inside is found to be dirty with oil												○
Check items	Oil level in damper chamber rises										◎		
Check items	Clamps for intake system are loose											◎	
Troubleshooting	When compression pressure is measured, it is found to be low		●	●									
Troubleshooting	When breather element is inspected, it is found to be clogged with dirty oil				●								
Troubleshooting	There is external leakage of oil from engine					●	●	●	●				
Troubleshooting	Pressure-tightness test of oil cooler shows there is leakage									●			
Troubleshooting	Excessive play of turbocharger shaft												
Troubleshooting	Inspect rear seal directly										●		
Troubleshooting	When intake manifold is removed, dust is found inside											●	
Troubleshooting	When intake manifold is removed, inside is unusually dirty												●
	Remedy		Replace	Replace	Clean	Correct	Correct	Correct	Correct	Replace	Correct	Correct	Correct

S-9 OIL BECOMES CONTAMINATED QUICKLY

General causes why oil becomes contaminated quickly

- Entry of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used

* The oil coolers are installed to only turbocharged engines.

			Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Defective safety valve	Exhaust smoke is black
Questions	Confirm recent repair history								
Questions	Degree of use of machine	Operated for long period	△			△			
Questions	Engine oil must be added more frequently		◎						
Questions	Non-specified oil is being used				○				
Check items	Color of exhaust gas	Blue under light load	◎						
Check items	Color of exhaust gas	Black							◎
Check items	Amount of blow-by gas	Excessive	◎			○			Carry out troubleshooting for "S-7 Exhaust smoke is black".
Check items	Amount of blow-by gas	None		◎					
Check items	When oil filter is inspected, metal particles are found		○		◎	○			
Check items	When exhaust pipe is removed, inside is found to be dirty with oil					◎			
Check items	Engine oil temperature rises quickly						◎		
Troubleshooting	When compression pressure is measured, it is found to be low		●			●			
Troubleshooting	When breather element is inspected directly, hose is dirty or is found to be clogged with dirty oil			●					
Troubleshooting	When oil filter is inspected directly, it is found to be clogged				●				
Troubleshooting	When oil cooler is inspected directly, it is found to be clogged						●		
Troubleshooting	When safety valve is directly inspected, spring is found to be catching or broken							●	
	Remedy		Replace	Clean	Replace	Replace	Clean	Replace	—

S-10 FUEL CONSUMPTION IS EXCESSIVE

General causes why fuel consumption is excessive

- Leakage of fuel
- Improper condition of fuel injection
- Excessive injection of fuel

			Causes: Defective injection pump (excessive injection)	Defective nozzle holder spray	Defective injection pump plunger	Defective fuel injection timing	External leakage from fuel piping, fuel filter	Defective oil seal inside feed pump (piston)	Defective adjustment of fuel lever linkage
Questions	Confirm recent repair history								
Questions	Degree of use of machine	Operated for long period		△	△			△	
Questions	Condition of fuel consumption	More than for other machines of same model	◎			○			
Questions	Condition of fuel consumption	Gradually increased		○	○				
Questions	Condition of fuel consumption	Suddenly increased					○		
Questions / Check items	Exhaust smoke color	Black	◎	○		○			○
Questions / Check items	Exhaust smoke color	White							
Check items	Seal on injection pump has come off		◎						
Check items	There is irregular combustion			◎					
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low			◎	○				
Check items	Timing lock on injection pump is misaligned					◎			
Check items	There is external leakage of fuel from engine						◎		
Check items	Engine oil level rises and smells of diesel fuel		○					◎	
Check items	Engine low idle speeds are high		○						◎
Troubleshooting	Injection pump measurement shows that injection amount is excessive		●						
Troubleshooting	Speed does not change when operation of certain cylinders is stopped			●					
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return				●				
Troubleshooting	Remove feed pump and inspect directly							●	
Troubleshooting	When engine speed is measured, low idle speeds are found to be high								●
	Remedy		Adjust	Replace	Replace	Adjust	Correct	Correct	Adjust

S-11 OIL IS IN COOLANT, OR WATER SPURTS BACK, OR WATER LEVEL GOES DOWN

General causes why oil is in coolant

- Internal leakage in lubrication system
- Internal leakage in cooling system

			Causes: Broken cylinder head, head gasket	Causes: Internal cracks in cylinder block
Questions	Confirm recent repair history			
Questions	Degree of use of machine	Operated for long period		
Questions	Oil level	Suddenly increased	○	
Questions	Oil level	Gradually increased		○
Questions	Hard water is being used as coolant			
Check items	Engine oil level has risen, oil is cloudy white			○
Check items	Excessive air bubbles inside radiator, spurts back		◎	
Trouble-shooting	Pressure-tightness test of cylinder head shows there is leakage		●	
Trouble-shooting	Remove oil pan and inspect directly			●
		Remedy	Replace	Replace

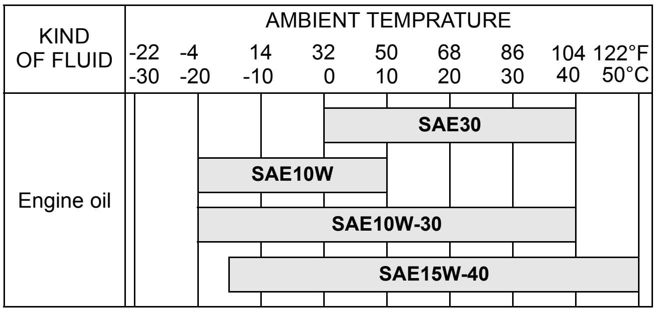
S-12 OIL PRESSURE CAUTION LAMP LIGHTS UP (DROP IN OIL PRESSURE)

General causes why oil pressure caution lamp lights up

- Leakage, clogging, wear of lubricating system
- Defective oil pressure control
- Improper oil used (improper viscosity)
- Deterioration of oil due to overheating

★ Before starting troubleshooting, check that the engine oil level is proper.

★ Standards for engine oil selection



			Clogged oil filter	Worn bearing, journal	Clogged strainer inside oil pan	Clogged oil pipe inside oil pan	Broken suction pipe brazing	Defective oil pump	Lack of oil in oil pan	Defective regulator valve	Defective safety valve	Leaking, crushed hydraulic piping	Defective oil pressure switch	Water, fuel in oil
Questions	Confirm recent repair history													
Questions	Degree of use of machine	Operated for long period	△	△				△						
Questions	Replacement of filters has not been carried out according to Operation Manual		◎											
Questions	Non-specified oil is being used		○	○										
Check items	Oil pressure monitor lights up		◎								○			
Check items	Condition when oil pressure caution lamp lights up	Lights up at low idle		◎							○			
Check items		Lights up at low, high idle	◎		◎	◎	◎	◎	○	○	○			
Check items		Lights up on slopes							◎					
Check items		Sometimes lights up								◎	◎		○	
Check items	There is crushing, leakage from hydraulic piping (external)											◎		
Check items	When oil level in oil pan is inspected, it is found to be low								◎					
Check items	Metal particles are found when oil is drained			◎										
Check items	Metal particles are stuck to oil filter element			◎				○						
Check items	Oil is cloudy white or smells of diesel oil													◎
Troubleshooting	When oil filter is inspected, it is found to be clogged		●	●										Carry out troubleshooting for "S-13 Oil level rises".
Troubleshooting	Remove oil pan and inspect directly				●	●	●							
Troubleshooting	Oil pump rotation is heavy, there is play							●						
Troubleshooting	There is catching of regulator valve or safety valve, spring or valve guide is broken									●	●			
Troubleshooting	When oil pressure is measured, it is found to be within standard value												●	
	Remedy		Clean	Clean	Clean	Clean	Correct	Replace	Add	Adjust	Adjust	Correct	Replace	—

S-13 OIL LEVEL RISES (WATER, FUEL IN OIL)

★ If there is oil in the coolant, carry out troubleshooting for "S-11 Oil is in coolant, or water spurts back, or water level goes down".

General causes why oil level rises

- Water in oil (milky white)
- Fuel in oil (diluted, and smells of diesel fuel)

		Causes: Defective nozzle holder sleeve	Broken cylinder head, head gasket	Defective seal of breather hole of water pump	Defective part inside injection pump (flange type)	Defective thermostat seat	Cracks inside cylinder block
Questions	Confirm recent repair history						
Questions	Degree of use of machine – Operated for long period	△		△			
Questions	There is oil in radiator coolant	○	○				○
Questions / Check items	Exhaust smoke is white	◎				○	
Questions / Check items	When engine is first started, drops of water come from muffler	◎					
Questions / Check items	Leave radiator cap open. When engine is run at idle, an abnormal number of bubbles appear, or water spurts back		◎				
Check items	Breather hole of water pump is clogged with mud			◎			
Check items	When breather hole of water pump is cleaned, water flows out of it			◎			
Check items	Engine oil smells of diesel fuel				◎	◎	
Check items	Fuel supply frequency is heightened				◎	◎	
Troubleshooting	Pressure-tightness test of cylinder head shows there is leakage	●					
Troubleshooting	When compression pressure is measured, it is found to be low		●				
Troubleshooting	Remove water pump and inspect directly			●			
Troubleshooting	Remove injection pump and inspect directly				●		
Troubleshooting	Defective contact with thermostat seat valve					●	
Troubleshooting	Remove oil pan and check directly						●
	Remedy	Replace	Replace	Replace	Replace	Correct	Replace

S-14 COOLANT TEMPERATURE BECOMES TOO HIGH (OVERHEATING)

General causes why coolant temperature becomes too high

- Lack of cooling air (deformation, damage of fan, fan belt slipping, worn fan pulley)
- Drop in heat dissipation efficiency
- Defective cooling circulation system

* The oil coolers are installed to only turbocharged engines.

			Causes									
			Broken water pump	Clogged, crushed radiator fins	Clogged radiator core	Defective thermostat (does not open)	Defective coolant temperature gauge	Lack of coolant	Fan belt slipping, worn fan pulley	Clogged, broken oil cooler	Defective radiator cap pressure valve	Broken cylinder head, head gasket
Questions	Confirm recent repair history											
Questions	Degree of use of machine	Operated for long period		△	△							△
Questions	Condition of overheating	Suddenly overheated	◎					○	○			
Questions	Condition of overheating	Always tends to overheat		◎	◎	○			○			
Questions	Coolant temperature gauge	Rises quickly				◎		○				
Questions	Coolant temperature gauge	Does not go down from red range					◎					
Questions / Check items	Fan belt whines under sudden load								◎			
Questions / Check items	Cloudy white oil is floating on coolant									◎		
Check items	Coolant flows out from overflow hose										◎	
Check items	Excessive air bubbles inside radiator, water spurts back											◎
Check items	Engine oil level has risen, oil is cloudy white									○		
Check items	There is play when fan pulley is rotated		◎									
Check items	Radiator shroud, inside of underguard are clogged with dirt or mud			◎					◎			
Check items	When light bulb is held behind radiator, no light passes through			◎								
Check items	Water is leaking because of cracks in hose or loose clamps							◎				
Check items	When belt tension is inspected, it is found to be loose								◎			
Troubleshooting	Temperature difference between top and bottom radiator tanks is excessive		●									
Troubleshooting	Temperature difference between top and bottom radiator tanks is slight			●								
Troubleshooting	When water filler port is inspected, core is found to be clogged				●							
Troubleshooting	When function test is carried out on thermostat, it does not open even at cracking temperature					●						
Troubleshooting	When coolant temperature is measured, it is found to be normal						●					
Troubleshooting	When oil cooler is inspected directly, it is found to be clogged									●		
Troubleshooting	When measurement is made with radiator cap tester, set pressure is found to be low										●	
Troubleshooting	When compression pressure is measured, it is found to be low											●
	Remedy		Replace	Correct	Correct	Replace	Replace	Add	Correct	Replace	Replace	Replace

S-15 ABNORMAL NOISE IS MADE

★ Judge if the noise is an internal noise or an external noise.

General causes why abnormal noise is made

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

			Causes: Excessive wear of piston ring, cylinder	Missing, seized bushing	Clogged, seized injection nozzle	Defective injection pump (rack, plunger seized)	Defective injection pump (excessive injection)	Deformed fan, fan belt loosen and interference	Defective adjustment of valve clearance	Broken dynamic valve system (valve, rocker lever, etc.)	Improper gear train backlash	Defect inside muffler (dividing board out of position)
Questions	Confirm recent repair history											
Questions	Degree of use of machine	Operated for long period	△									
Questions	Condition of abnormal noise	Gradually occurred	○					○				
Questions	Condition of abnormal noise	Suddenly occurred		○						○		
Questions	Non-specified fuel is being used				○	○						
Questions	Engine oil must be added more frequently		◎									
Questions / Check items	Color of exhaust gas	Blue under light load	◎									
Questions / Check items	Color of exhaust gas	Black							○			
Questions / Check items	Metal particles are found in oil filter		◎	◎								
Check items	Blow-by gas is excessive		◎									
Check items	Noise of interference is heard from around turbocharger											
Check items	Engine pickup is poor and combustion is abnormal				◎							
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low				◎	○						
Check items	Seal on injection pump has come off						◎					
Check items	Abnormal noise is loud when accelerating engine				○	○	○	○	○		○	
Check items	Clanging sound is heard from around cylinder head								◎	◎		
Check items	Vibrating noise is heard from around muffler											◎
Troubleshooting	When compression pressure is measured, it is found to be low		●									
Troubleshooting	Remove gear cover and inspect directly			●							●	
Troubleshooting	Speed does not change when operation of certain cylinders is stopped				●							
Troubleshooting	When control rack is pushed, it is found to be heavy, or does not return					●						
Troubleshooting	Injection pump test shows that injection amount is incorrect						●					
Troubleshooting	Fan is deformed, belt is loose							●				
Troubleshooting	When valve clearance is checked, it is found to be outside standard value								●			
Troubleshooting	Remove cylinder head cover and inspect directly									●		
Troubleshooting	When muffler is removed, abnormal noise disappears											●
	Remedy		Replace	Replace	Replace	Correct	Replace	Correct	Replace	Correct	Replace	Replace

S-16 VIBRATION IS EXCESSIVE

★ If there is abnormal noise together with the vibration, carry out troubleshooting also for "S-15 Abnormal noise is made".

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Improper alignment
- Abnormal combustion

			Causes: Worn connecting rod, main bearing	Worn cam bushing	Loose engine mounting bolts, broken cushion	Broken part inside damper or output shaft	Improper gear train backlash	Defective dynamic valve system (valve, rocker lever, etc. stuck)	Defective injection pump (excessive fuel injection)
Questions	Confirm recent repair history								
Questions	Degree of use of machine	Operated for long period	△	△	△				
Questions	Condition of vibration	Suddenly increased				○		○	
Questions	Condition of vibration	Gradually increased	○	○	○				
Questions	Non-specified oil is being used		○	○					
Check items	Metal particles are found in oil filter		◎	◎					
Check items	Metal particles are found when oil is drained		◎	◎					
Check items	Oil pressure is low at low idle		○	○					
Check items	Vibration occurs at mid-range speed				○	○			
Check items	Vibration follows engine speed				○	○	○		
Check items	Exhaust smoke is black							◎	○
Check items	Seal on injection pump has come off								◎
Troubleshooting	Remove oil pan and inspect directly		●						
Troubleshooting	Remove side cover and inspect directly			●					
Troubleshooting	Inspect directly for loose engine mounting bolts, broken cushion				●				
Troubleshooting	Inspect inside damper or output shaft directly					●			
Troubleshooting	Remove front cover and inspect directly						●		
Troubleshooting	Remove cylinder head cover and inspect directly							●	
Troubleshooting	Injection pump test shows that injection amount is incorrect								●
	Remedy		Replace	Replace	Replace	Replace	Correct	Replace	Adjust

30 DISASSEMBLY AND ASSEMBLY

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HOW TO READ THIS MANUAL

REMOVAL AND INSTALLATION OF ASSEMBLIES

SPECIAL TOOLS

- Special tools that are deemed necessary for removal or installation of parts are listed.
- List of the special tools contains the following kind of information
  1) Necessity
     ■: Special tools which cannot be substituted, should always be used.
     ●: Speciall tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools.
     N: Tools with new part numbers, newly developed for this model.
     R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     Blank: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column.
     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T---×××---××××.

REMOVAL OF PARTS

- The REMOVAL Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the REMOVAL Section are explained and listed below.

This mark indicates safety-related precautions, which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

[*1] This mark shows that there are instructions or precautions for installing parts.

This mark shows oil or water be drained.

This mark shows the weight of a part or a device.

INSTALLATION OF PARTS

- Except where otherwise instructed, install parts is the reverse order of removal.
- Instructions and precautions for installing part are shown with [*1] mark in the INSTALLATION Section, identifying which step the instructions are intended for.
- Marks shown in the INSTALLATION Section stand for the following.

This mark indicates safety-related precautions, which must be followed when doing the work.

★ This marks gives guidance or precautions when doing the procedure.

This mark stands for a specific coating agent to be used.

This mark indicates the specified torque.

This mark indicates an amount of oil or water to be added.

SKETCHES OF SPECIAL TOOLS

- Various special tools are illustrated for the convenience of local manufacture.

DISASSEMBLY AND ASSEMBLY OF ASSEMBLIES

SPECIAL TOOLS

- Special tools which are deemed necessary for disassembly and assembly are listed in this section.
- List of the special tools contains the following kind of information.
  1) Necessity
     ■: Special tools which cannot be substituted, should always be used.
     ●: Speciall tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools.
     N: Tools with new part numbers, newly developed for this model.
     R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     Blank: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column.
     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.
  4) Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T---×××---××××.

DISASSEMBLY

- The DISASSEMBLY Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the DISASSEMBLY Section are explained and listed below.

 This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

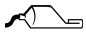
 This mark shows oil or water to be drained.

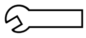
ASSEMBLY

- Section titled ASSEMBLY contain procedures, precautions and the know-how for the work, as well as the amount of oil or water to be added.
- Various symbols used in the ASSEMBLY Section are explained and listed below.

 This mark indicates safety-related precautions, which must be followed when doing the work.

★ This marks gives guidance or precautions when doing the procedure.

 This mark stands for a specific coating agent to be used.

 This mark indicates the specified torque.

 This mark indicates an amount of oil or water to be added.

SKETCHES OF SPECIAL TOOLS

1) Vartious special tools are illustrated for the convenience of local manufacture.

PRECAUTIONS WHEN PERFORMING OPERATION

Be sure to follow the general precautions given below when performing removal or installation (disassmbly or assembly) of units.

1. Precautions when performing removal work

- If the engine coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or install blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To avoid loosening any wire contacts, do not pull on the wires. In-order to prevent excessive force to the wiring, hold onto the connectors when disconnecting them.
- Fasten tags to wires and hoses to identify and show their installation position and help to prevent any mistakes when re-installing.
- Count and check the number and thickness of the shims, and keep them in a safe place.
- When raising or lifting components, be sure to use proper lifting equipment of ample strength and safety.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and install a cover to prevent any dust or dirt from entering after removal.

★ **Precautions when handling piping during disassembling**

Fit the following blind plugs into the piping after disconnecting it during disassembly operations.

A. Face seal type hoses and tubes

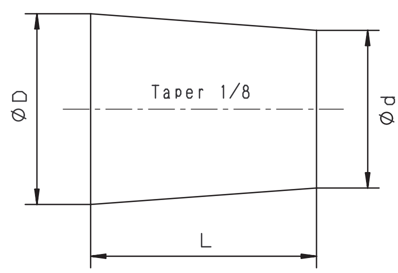
Nominal number	Plug (nut end)	Nut (elbow end)
02	07376-70210	02789-00210
03	07376-70315	02789-00315
04	07376-70422	02789-00422
05	07376-70522	02789-00522
06	07376-70628	02789-00628

B. Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

C. If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



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2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pins or lock plate securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with tow or three drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press fitting parts, coat the surface with anti-friction compound (LM-P).
- After installing snap rings, check that the snap ring is installed securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:

1. Start the engine and run it at low idle.
2. Operate the work equipment control lever to operate the hydraulic cylinders, 4 – 5 times, stopping the cylinder 100 mm from the end of their stroke.
3. Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
4. After doing this, run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operations

- If the engine coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
- If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- If the piping or hydraulic equipment have been removed for repair, Bleed the air from the system after reassembling the parts.

★ For details, see TESTING AND ADJUSTING, Bleeding air.

- Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.

SPECIAL TOOL LIST

★ Tools with part number 79○T-○○○-○○○○ cannot be supplied (they are items to be locally manufactured).
★ Necessity: ■.........Cannot be substituted, must always be installed (used)
●.........Extremely useful if available or, can be substituted with commercially available part.
★ New/Remodel: N.........Tools with new part numbers, newly developed for this model.
: R.........Tools with upgraded part numbers, remodeled from items already available for other models.
:Blank:...Tools already available for other models, can be used without any modification
★ Tools marked ○ in the Sketch column are tools introduced in the sketches of the special (See SKETCHES OF SPECIAL TOOLS).

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of swing motor and swing machinery assembly	F	1	796T-126-1210	Wrench	■	1	N	○	PC27,30, 35MR-2	Removal, installation of nut
			796T-126-1410	Wrench	■	1	N	○	PC40,50MR-2	
		2	790-101-5001	Push tool KIT	■	1			PC27,30, 35MR-2	Press fitting of oil seal
			790-101-5151	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-101-5201	Push tool KIT	■	1			PC40,50MR-2	
			790-101-5251	• Plate		1				
			790-101-5221	• Grip		1				
			01010-51225	• Bolt		1				
		3	790-101-5201	Push tool KIT	●	1			PC27,30, 35MR-2	Press fitting of outer race (small)
			790-101-5271	• Plate		1				
			790-101-5221	• Grip		1				
			01010-51225	• Bolt		1				
			790-101-5201	Push tool KIT	●	1			PC40,50MR-2	
			790-101-5311	• Plate		1				
			790-101-5221	• Grip		1				
			01010-51225	• Bolt		1				
		4	790-101-5201	Push tool KIT	●	1			PC27,30, 35MR-2	Press fitting of outer race (large)
			790-101-5331	• Plate		1				
			790-101-5221	• Grip		1				
			01010-51225	• Bolt		1				
			790-101-5201	Push tool KIT	●	1			PC40,50MR-2	
			790-101-5341	• Plate		1				
			790-101-5221	• Grip		1				
			01010-51225	• Bolt		1				

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of swing motor and swing machinery assembly	F	5	796-760-9110	Push tool	■	1			PC27,30, 35MR-2	Press fitting of bearing (small)
			796-465-1120	Push tool	■	1			PC40,50MR-2	
		6	790-445-3810	Push tool	■	1			PC27,30, 35MR-2	Press fitting of bearing (large)
			795-765-1110	Push tool	■	1			PC40,50MR-2	
Disassembly, assembly of idler assembly	L	1	790-101-5001	Push tool KIT	●	1			Press fitting of bushing	
			790-101-5081	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
		2	791-430-3230	Installer	■	1			Installation of floating seal	
Disassembly, assembly of track roller assembly		3	790-101-5001	Push tool KIT	●	1				Press fitting of bushing
			790-101-5051	• Plate		1			PC27,30, 35MR-2	
			790-101-5081	• Plate		1			PC40,50MR-2	
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
		4	790-434-1660	Installer	■	1			PC27,30, 35MR-2	Installation of floating seal
			791-430-3230	Installer	■	1			PC40,50MR-2	
Disassembly, assembly of carrier roller		5	790-101-5001	Push tool KIT	●	1			Press fitting of ball bearing and cap	
			790-101-5081	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
		6	790-101-5001	Push tool KIT	●	1			Press fitting of dust seal	
			790-101-5111	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
Disassembly, assembly of recoil spring assembly	M		792-371-1400	Sleeve	■	1			Disassembly, assembly of recoil spring assembly	
Disassembly, assembly of center swivel joint assembly	T		790-101-2501	Push puller	●	1			Separation of rotor and swivel joint	
			790-101-2510	• Block		1				
			790-101-2520	• Screw		1				
			791-112-1180	• Nut		1				
			790-101-2540	• Washer		1				
			790-101-2630	• Leg		2				
			790-101-2570	• Plate		4				

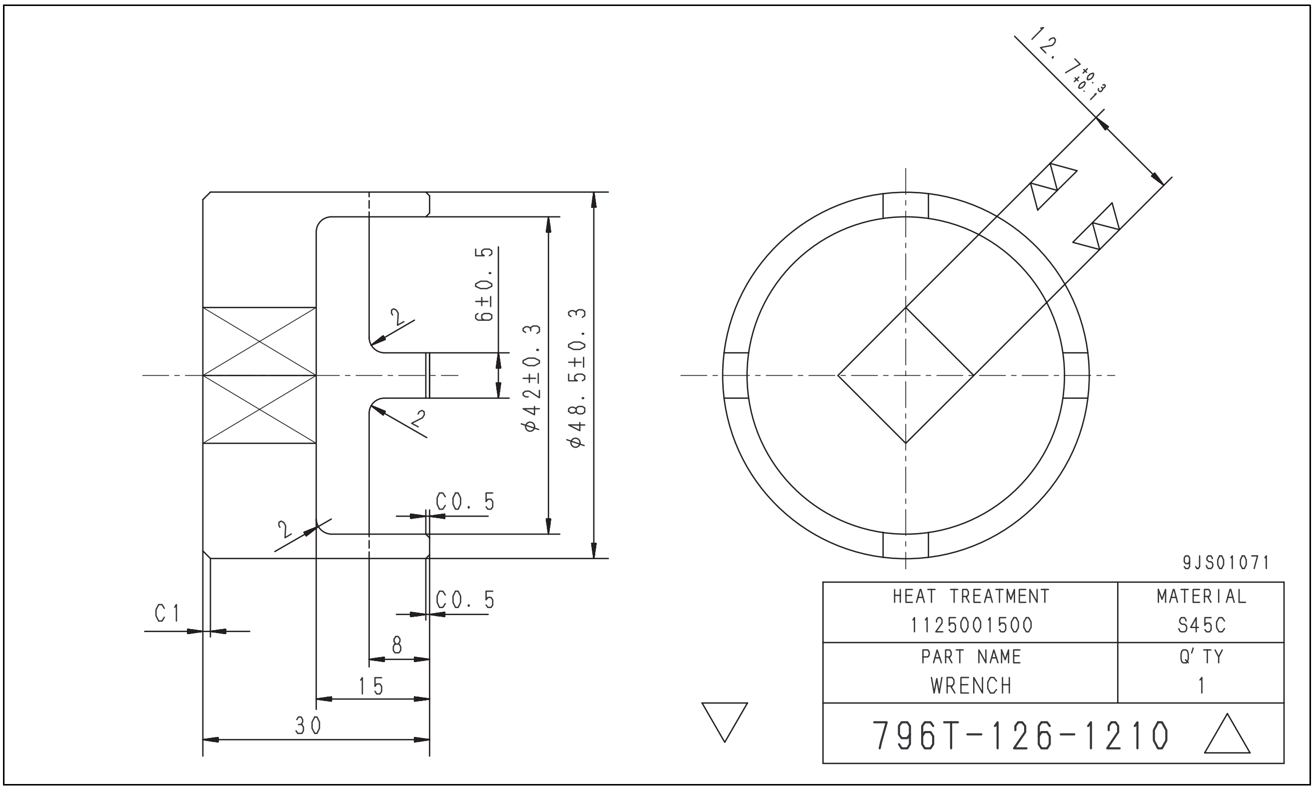
Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of center swivel joint assembly	T		790-101-2560	• Nut		2			Separation of rotor and swivel joint	
			790-101-2660	• Adapter		2				
Disassembly, assembly of hydraulic cylinder assembly	U	1	790-502-1003	Cylinder repair stand	■	1			Disassembly, assembly of hydraulic cylinder assembly	
			790-101-1102	Hydraulic pump	■	1				
		2	790-330-1100	Wrench assembly	■	1			Removal, installation of cylin-der head	
		3	Commercially available	Socket	■	1			Width across flats: 41 mm	Removal, installation of piston nut
			Commercially available	Socket	■	1			Width across flats: 46 mm	
			790-302-1390	Socket	■	1			Width across flats: 46 mm, long type	
			790-302-1270	Socket	■	1			Width across flats: 50 mm	
			790-302-1490	Socket	■	1			Width across flats: 50 mm, long type	
			790-302-1280	Socket	■	1			Width across flats: 55 mm	
			790-302-1470	Socket	■	1			Width across flats: 55 mm, long type	
		4	790-201-1702	Push tool KIT	■	1			Press fitting of bushing	
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1731	• Push tool		1				
			790-201-1751	• Push tool		1				
			790-201-1741	• Push tool		1				
			790-201-1761	• Push tool		1				
		5	790-201-1500	Push tool KIT	■	1			Press fitting of dust seal	
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1540	• Plate		1				
			790-201-1560	• Plate		1				
			790-201-1550	• Plate		1				
			790-201-1570	• Plate		1				
		6	790-720-1000	Expander	●	1			PC27MR-2 boom, swing PC30MR-2 boom,arm,swing PC35MR-2 boom,arm PC50MR-2 bucket	Installation of piston ring
		7	796-720-1630	Ring	●	1			PC27MR-2 bucket	
			07281-00709	Clamp	●	1				

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of hydraulic cylinder assembly	U	7	796-720-1640	Ring	●	1			PC27MR-2 boom, swing PC30MR-2 boom,arm,swing PC35MR-2 boom,arm PC50MR-2 bucket	Installation of piston ring
			07281-00909	Clamp	●	1				
			796-720-1740	Ring	●	1			PC27MR-2 arm PC30,35,40MR-2 bucket	
			07281-00809	Clamp	●	1				
			796-720-1650	Ring	●	1			PC27,30MR-2 blade PC35MR-2 swing, blade PC40, 50MR-2 boom,arm,swing	
			07281-01029	Clamp	●	1				
			796-720-1660	Ring	●	1			PC40, 50MR-2 blade	
			07281-00159	Clamp	●	1				
Removal, installation of air conditioner unit assembly	X	1	799-703-1200	Service tool KIT	■	1			Charging with refrigerant	
			799-703-1100	Vacuum pump	■	1				
			799-703-1110	Vacuum pump	■	1				
			799-703-1120	Vacuum pump	■	1				
			799-703-1401	Gas leak detector	■	1				
Removal, installation of operator's cab glass (stuck glass)		2	793-498-1210	Lifter (Suction cup)	■	2			Fixing of window glass	

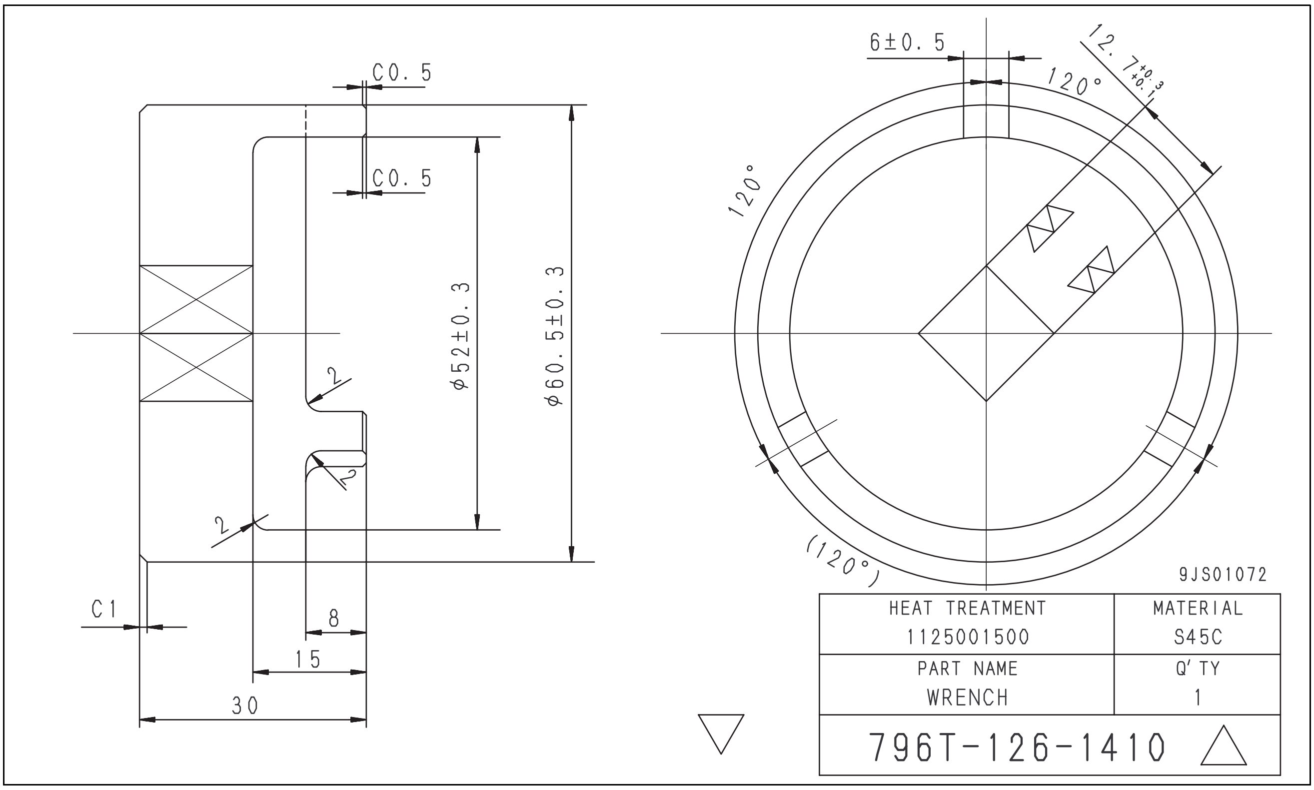
SKETCHES OF SPECIAL TOOLS

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches

F1 Wrench (PC27, 30, 35MR-2)



F1 Wrench (PC40, 50MR-2)

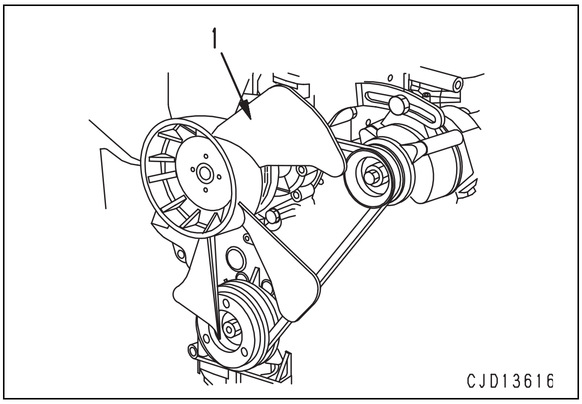


REMOVAL AND INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

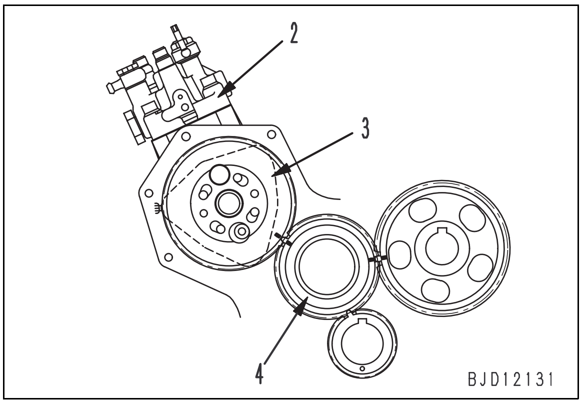
REMOVAL

1. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

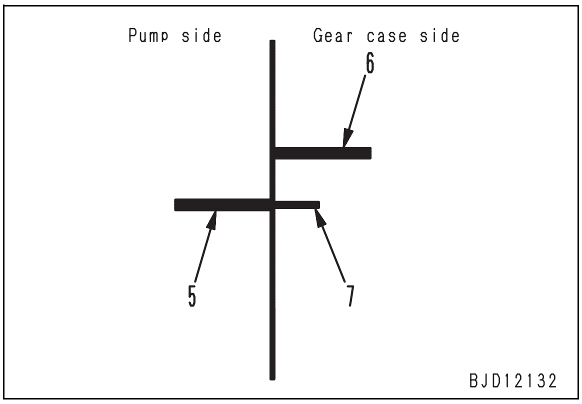
2. Loosen the fan belt and remove fan (1). [*1]
   ★ Before removing fan (1), make a match mark on it and mounting part.



3. Before removing fuel injection pump (2), remove the front cover of the timing gear case and make match marks with paint on the meshing parts of pump drive gear (3) and idle gear (4).

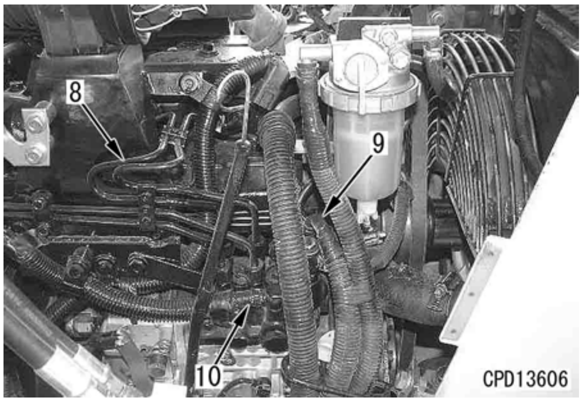


4. Take an accurate record of the positions of stamp line (5) of the fuel injection pump body and stamp line (6) of the gear case by making mark (7) on the gear case.

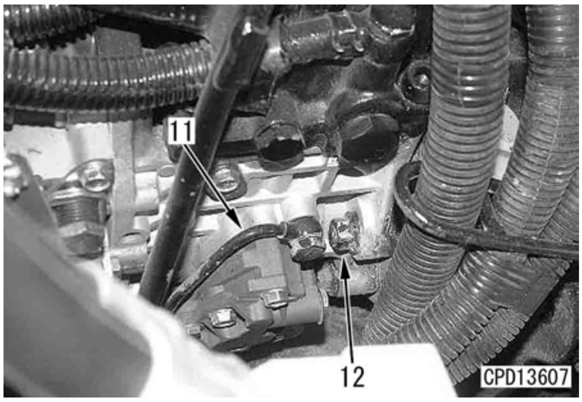


5. Remove fuel tube (8). [*2]

6. Disconnect fuel hoses (9) and (10) and engine stop solenoid connector.

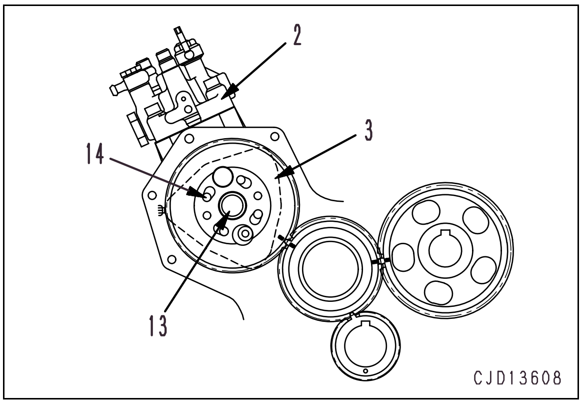


7. Remove lubrication tube (11) and 3 fuel injection pump mounting nuts (12).



8. Remove nut (13) from the end of the fuel injection pump drive shaft. [*3]
   ★ Take care not to drop the nut into the case.
   ★ Never loosen mounting bolts (14) of pump drive gear (3) and flange. (If the flange and pump drive gear move from each other, it becomes very difficult to adjust the injection timing.)

9. Using a puller, push out the pump drive shaft from the gear and remove fuel injection pump assembly (2). [*4]



CJD13608

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]
★ When installing the fan, line up the match marks.
★ Check that the identification mark (M) of the fan is on outside.

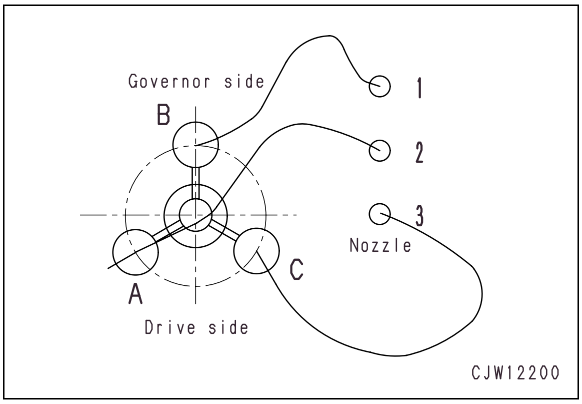
Machine model	Engine type	Identification mark (M)
PC27MR-2	3D82AE	T
PC30MR-2	3D84E	YA
PC35MR-2	S3D84E	YA
	3D88E	YA
PC40MR-2	4D88E	KS
PC50MR-2	4D88E	KS

- Sample of identification mark

AJE00011

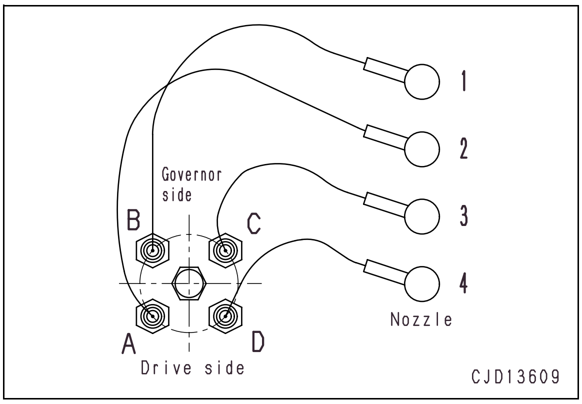
[*2]
★ Referring to the following figure, install the fuel tube.
★ The cylinder of the engine on the flywheel side is the No. 1 cylinder.

PC27, 30, 35MR-2



CJW12200

PC40, 50MR-2



CJD13609

[*3]
Nut at shaft end:
113 – 123 Nm {11.5 – 12.5 kgm}

[*4]
★ Install the fuel injection pump temporarily, and then tighten the nut at the shaft end first.
★ Adjust the injection angle. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.

REMOVAL AND INSTALLATION OF RADIATOR AND HYDRAULIC OIL COOLER ASSEMBLY

PC27, 30, 35MR-2

REMOVAL

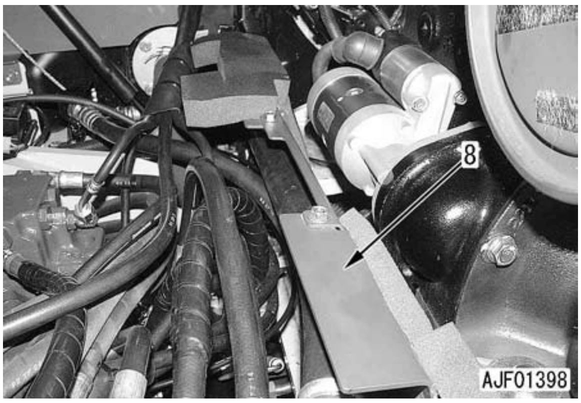
1. Release the air pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing air in hydraulic tank.

2. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

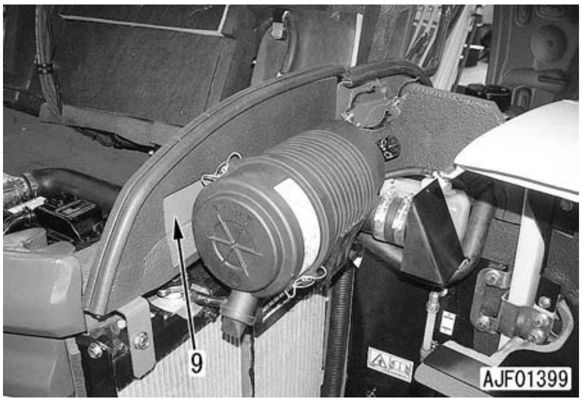
3. Drain the coolant.
   Coolant: **3.3 ℓ**

4. Remove cover (7).

5. Remove all the mounting bolts of plate (8) on the left side of the engine.
   ★ Since the plate cannot be removed, set it so that it can be removed.

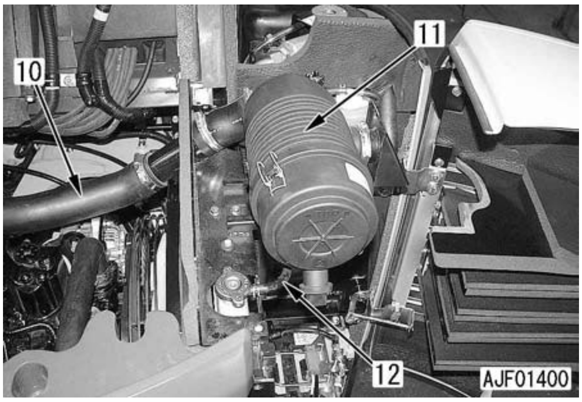


6. Open the rear cover of the machine and right side cover. Remove all the mounting bolts of plate (9) on the right side of the engine, and then raise the plate toward the front of the machine and secure it with ropes, etc.

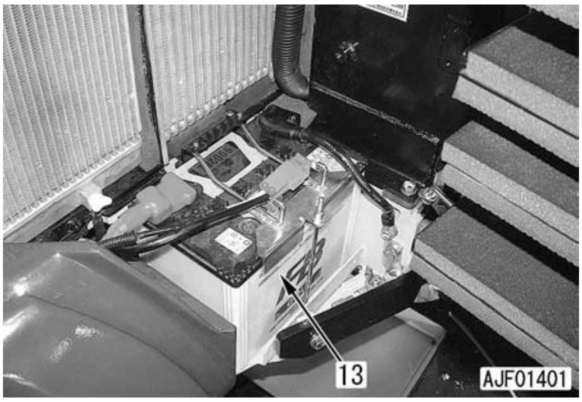


7. Remove air hose (10) and air cleaner case and bracket assembly (11).

8. Remove reservoir tank hose (12).

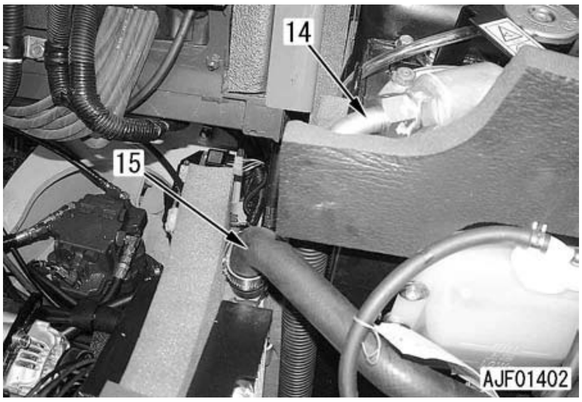


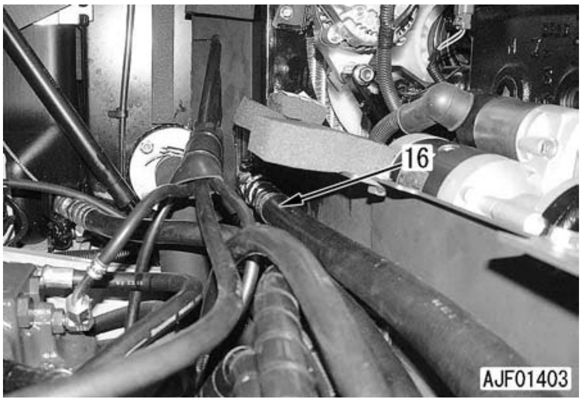
9. Remove battery (13).



10. Disconnect tube (14).

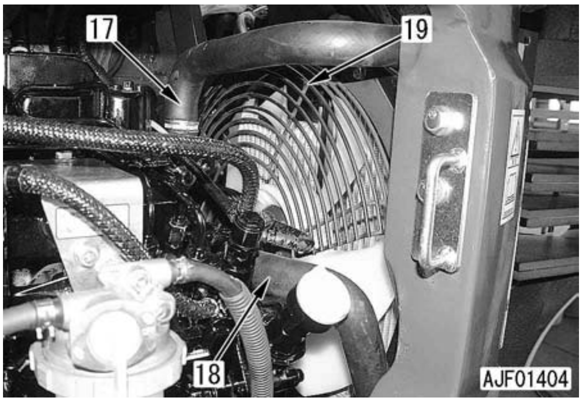
11. Disconnect hoses (15) and (16) from the hydraulic oil cooler.





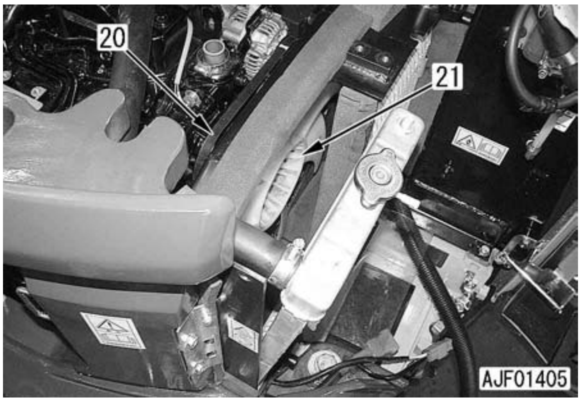
12. Disconnect hoses (17) and (18) from the engine.

13. Remove fan guard (19).

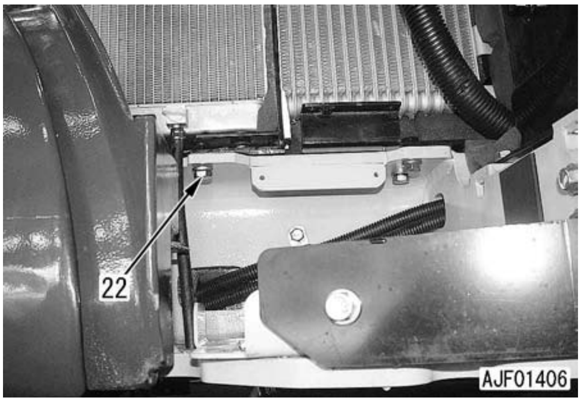


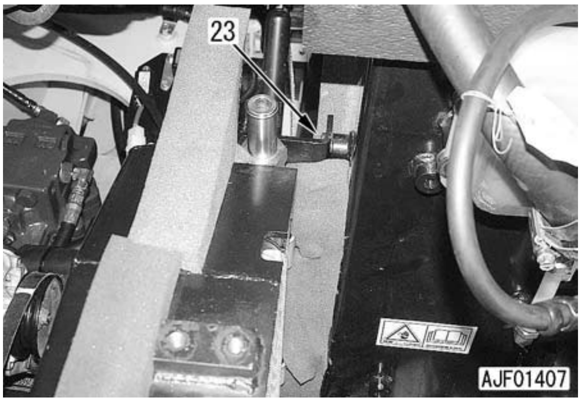
14. Loosen alternator belt (20). [*1]

15. While leaning the radiator toward this side, remove cooling fan (21).
    ★ Return the radiator.

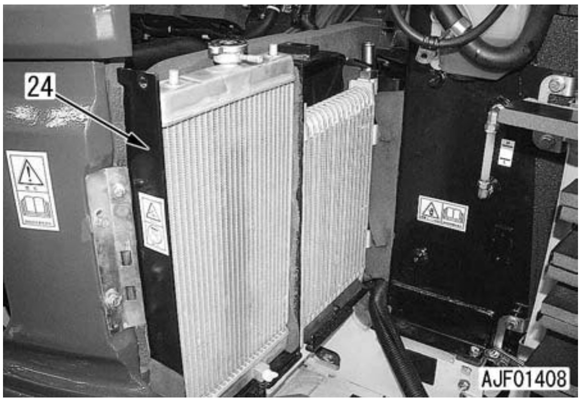


16. Remove 4 mounting bolts (22) on the lower side of the radiator and 1 mounting bolt (23) on the hydraulic tank side.

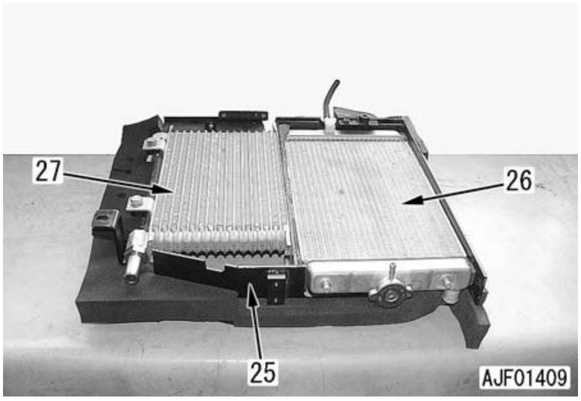




17. Remove radiator and hydraulic oil cooler assembly (24).
    ★ Moving plate (8) on the left side of the engine (See step 5), remove the assembly. At this time, take care not to damage the core.



18. Remove radiator (26) and hydraulic oil cooler (27) from shroud (25).



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]
★ Adjust the belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting alternator belt tension.

- **Refilling with water**

★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again.

Coolant: **3.3 ℓ**

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

PC40, 50MR-2

REMOVAL

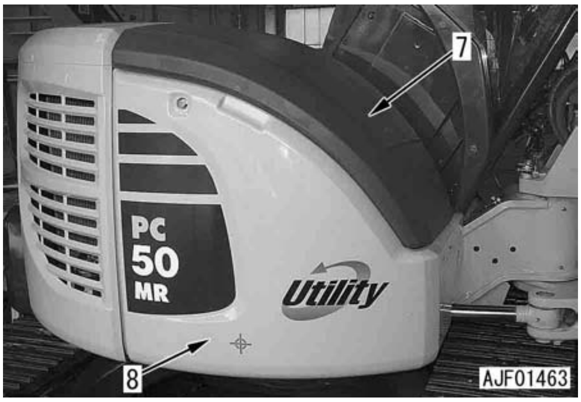
1. Release the air pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing air in hydraulic tank.

2. Tilt up the floor frame. For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

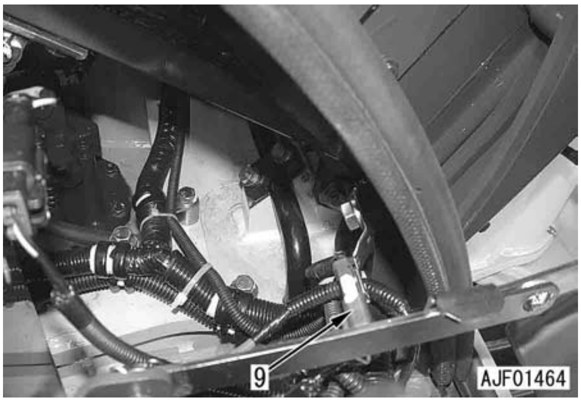
3. Drain the coolant.

   Coolant: **7.3 ℓ**

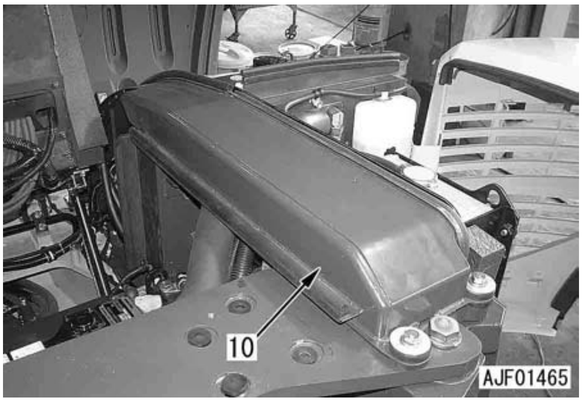
4. Open cover (7) and remove cover (8).



5. Remove working lamp wiring harness connector (9) from the bracket on the left side of the battery.

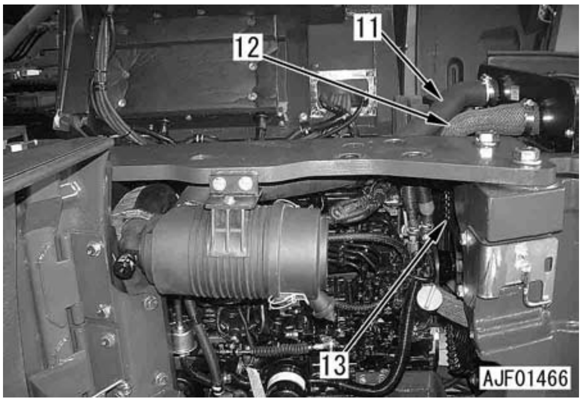


6. Remove cover (10).

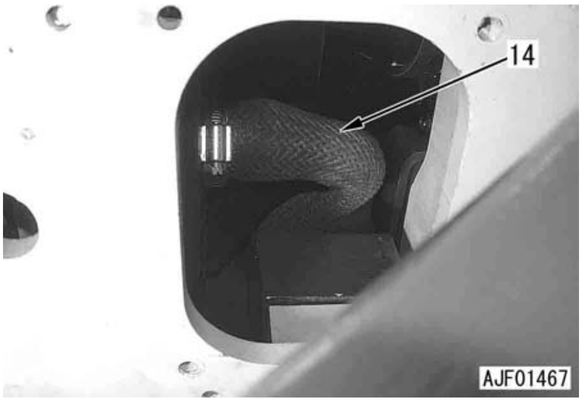


7. Disconnect air duct (11) and hose (12). [*1]

8. Remove fan guard (13).

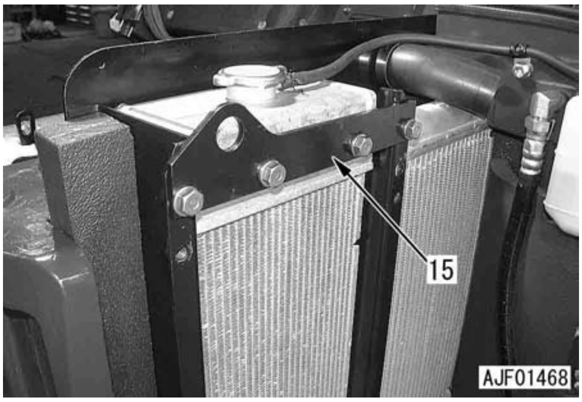


9. Remove the undercover and disconnect hose (14). [*1]

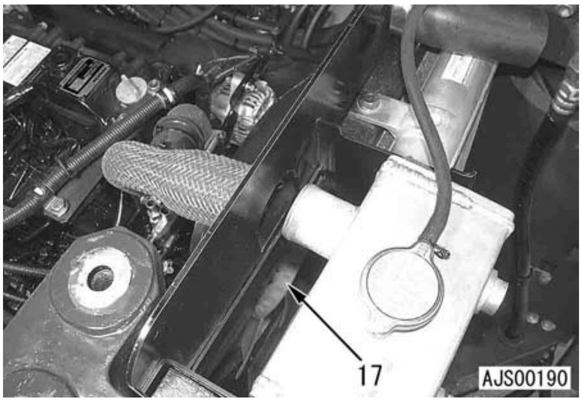


10. Loosen the alternator belt. [*2]

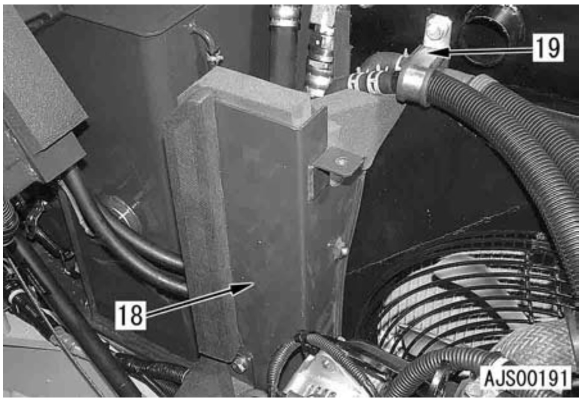
11. Remove plate (15).



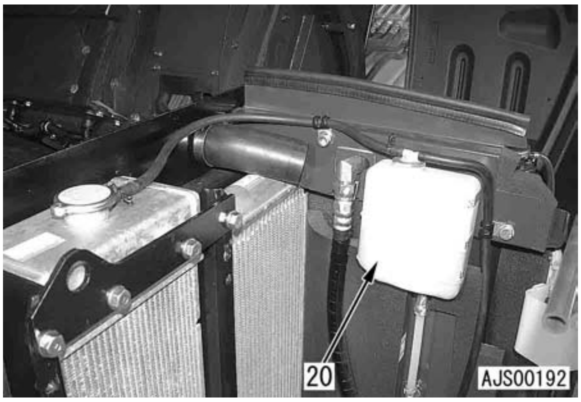
12. While leaning the radiator toward this side, remove cooling fan (17).
    ★ Return the radiator.



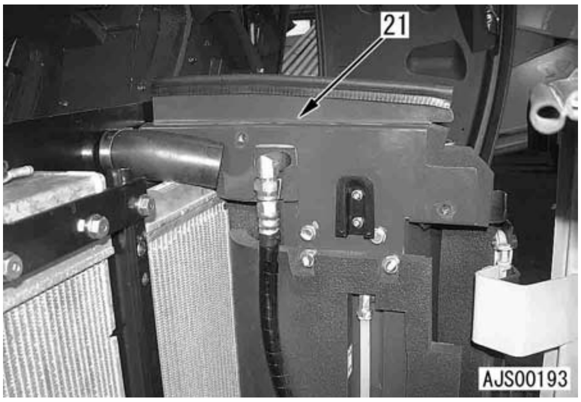
13. Remove cover (18) and clamp (19) and move heater hose (2 pieces).



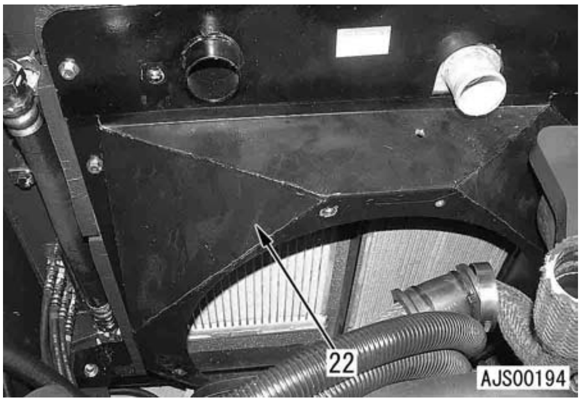
14. Remove reservoir tank (20).



15. Remove plate (21).

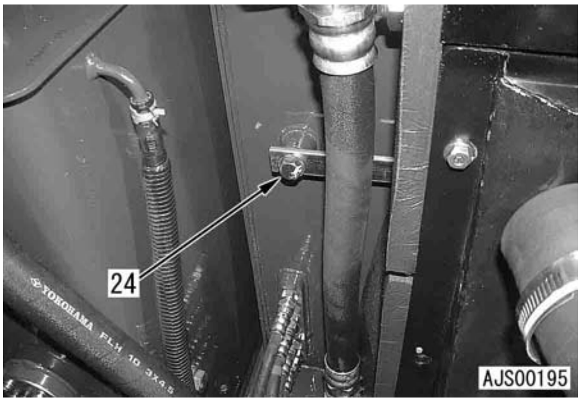


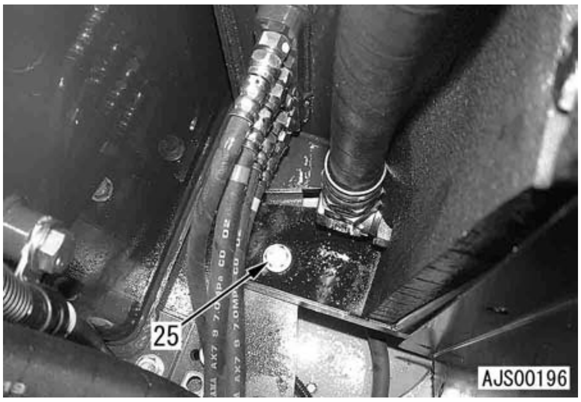
16. Remove all the mounting bolts of shroud (22).
    ★ The shroud cannot be removed at this time.

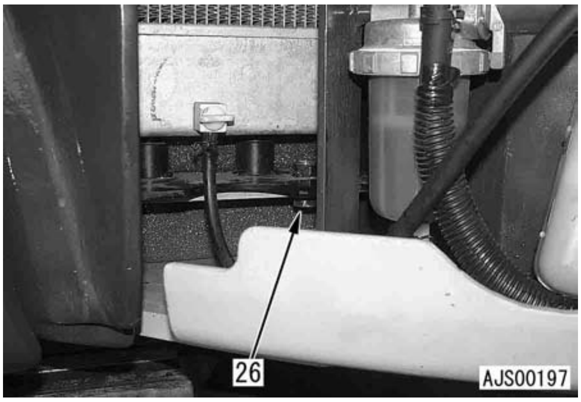


17. Sling the radiator and hydraulic oil cooler assembly temporarily.

18. Remove mounting bolts (24), (25), and (26) (2 pieces). [*3]

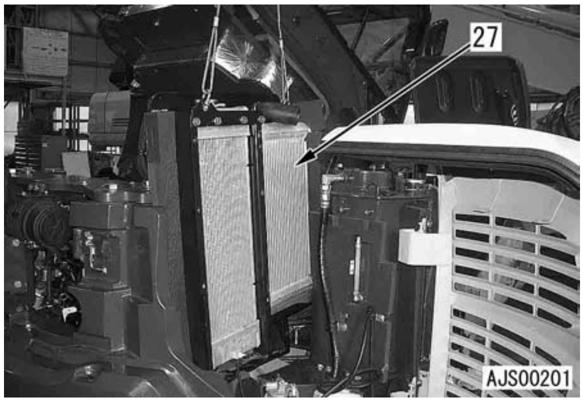




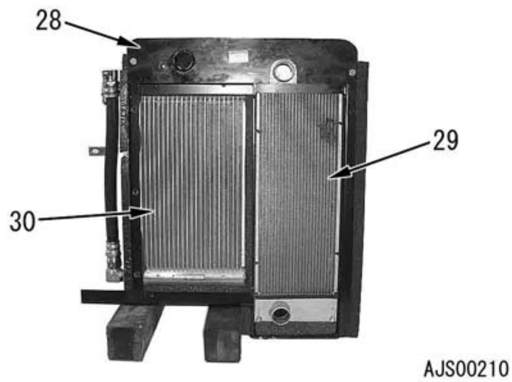


19. Lift off radiator and hydraulic oil cooler assembly (27).
    ★ Remove the radiator and hydraulic oil cooler assembly without removing the fan shroud.
    ★ When removing the radiator and hydraulic oil cooler assembly, take care not to damage the core.

    Radiator and hydraulic oil cooler assembly: **35 kg**



20. Remove radiator (29) and hydraulic oil cooler (30) from shroud (28).



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*2]

★ Adjust the belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting alternator belt tension.

[*3]

Mounting bolts
(24): **59 – 74 Nm {6 – 7.5 kgm}**
(25), (26): **98 – 123 Nm {10 – 12.5 kgm}**

- **Refilling with water**

★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again.

Coolant: **7.3 ℓ**

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

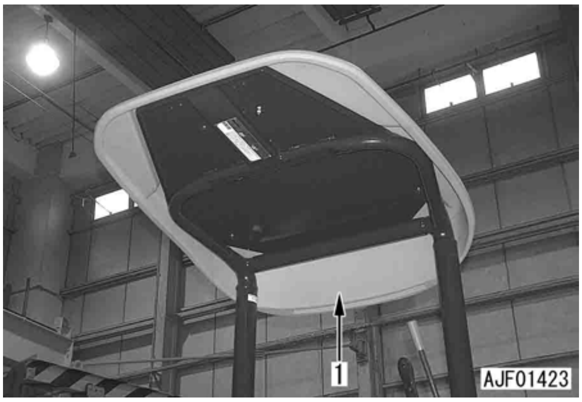
REMOVAL AND INSTALLATION OF ENGINE AND HYDRAULIC PUMP ASSEMBLY

PC27, 30, 35MR-2

REMOVAL

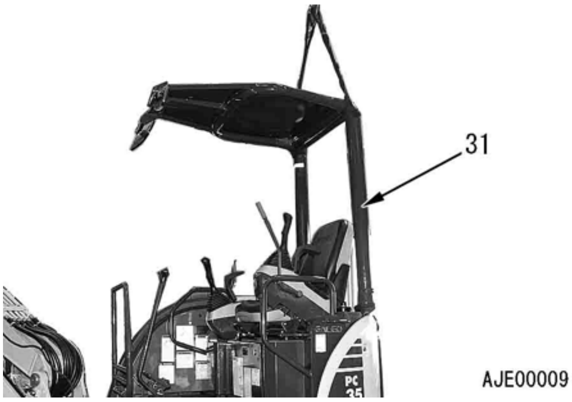
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Canopy roof and canopy.
   (Only for PC35MR-2, Serial No. 9242 and up for North America)
   1) Lift off canopy roof (1).



   2) Lift off canopy (31).

   Canopy **77 kg**



2. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

3. Drain the coolant.

   Coolant: **3.3 ℓ**

4. Drain the hydraulic oil.

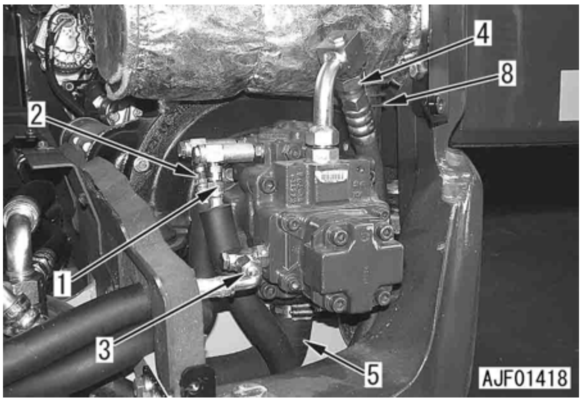
   Hydraulic oil: **20 ℓ**

5. Perform the following work. (For details, see REMOVAL AND INSTALLATION OF RADIATOR AND HYDRAULIC OIL COOLER ASSEMBLY, steps 4 - 7 and 12 - 15.)
   - Removal of cover on left side of machine
   - Removal of mounting bolts of plate on left side of engine
   - Shifting of plate in front of engine to front of machine
   - Removal of air cleaner case and bracket assembly
   - Separation of 2 radiator hoses
   - Removal of fan guard
   - Removal of cooling fan [*1]

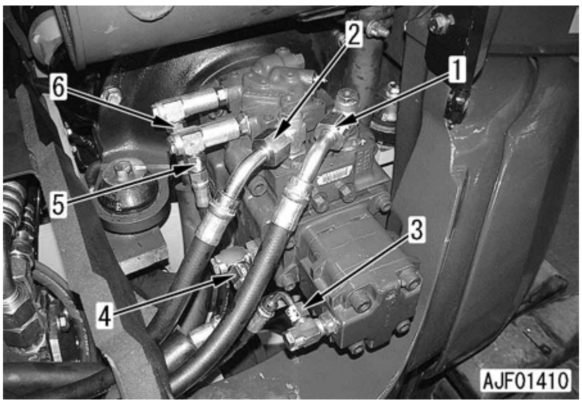
6. Disconnect hoses (1) – (7) from the hydraulic pump.

7. Remove exhaust tube (8).

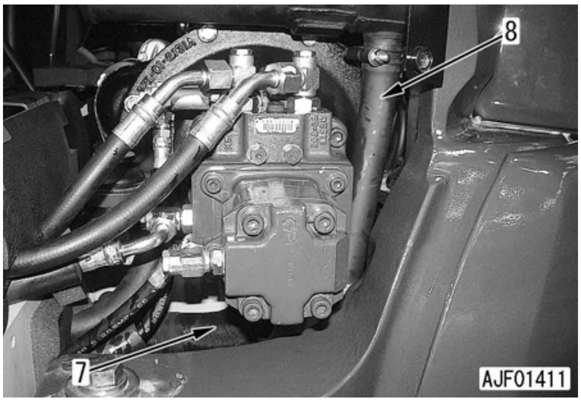
PC27, 30MR-2



PC35MR-2

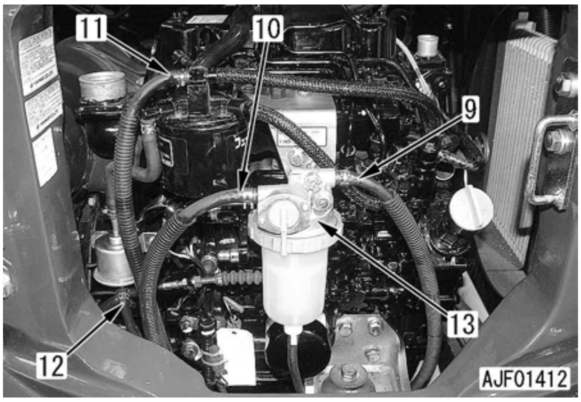


PC35MR-2

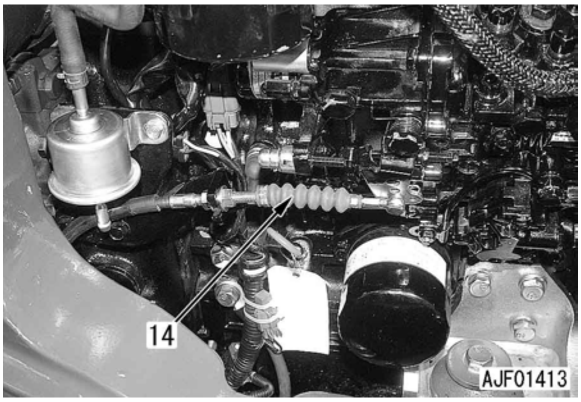


8. Disconnect hoses (9) – (12).

9. Remove water separator (13) and bracket together.

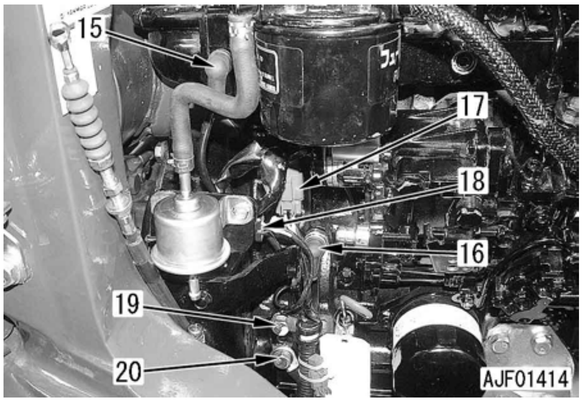


10. Remove fuel control cable (14). [*2]
    ★ Before removing the fuel control cable, check its installed dimension.



11. Disconnect terminals (15) and (16) and connectors (17) and (18).

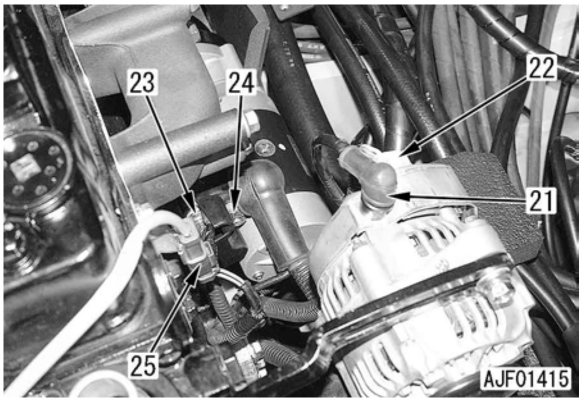
12. Remove wiring harness clamp (19) and ground cable (20).



13. Disconnect terminal (21) and connector (22) from the alternator.

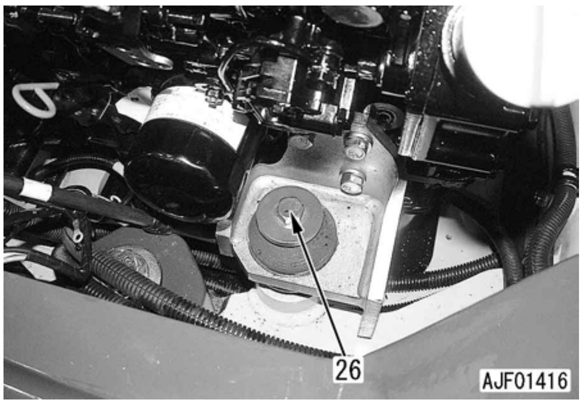
14. Disconnect terminals (23) and (24) from the starting motor.

15. Disconnect connector (25).



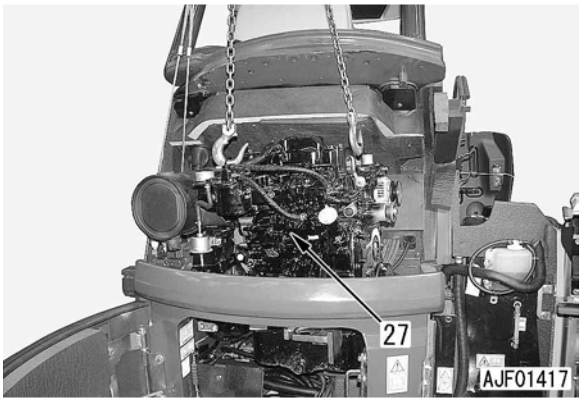
16. Sling the engine and hydraulic pump assembly temporarily.

17. Remove 4 mounting bolts (26).



18. Lift off engine and hydraulic pump assembly (27).
    - ★ Check that all the wires and pipes have been disconnected.
    - ★ When removing the engine and hydraulic pump assembly, take care that it will not interfere with other parts.

    Engine and hydraulic pump assembly: **230 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting alternator belt tension.

[*2]

★ Adjust the cable tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel control lever.

- **Refilling with water**

★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again.

Coolant: **3.3 ℓ**

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Hydraulic oil: **20 ℓ (EO10-DH)**

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

PC40, 50MR-2

REMOVAL

1. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

   ⚠ Disconnect the cable from the negative (–) terminal of the battery.

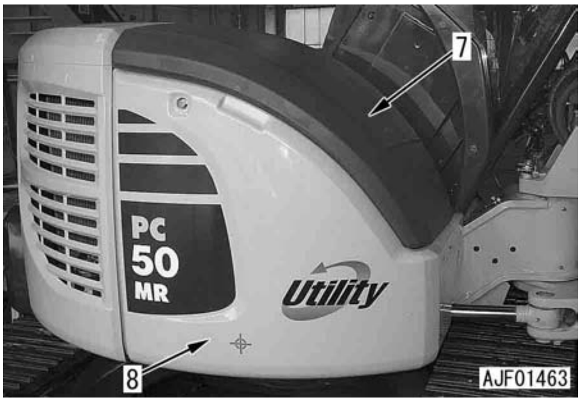
2. Drain the coolant.

   Coolant: **7.3 ℓ**

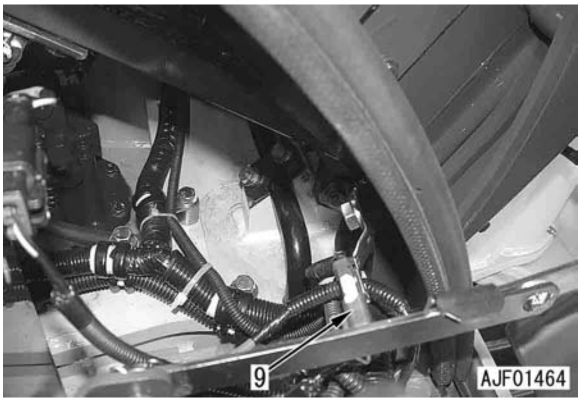
3. Drain the hydraulic oil.

   Hydraulic oil: **20 ℓ**

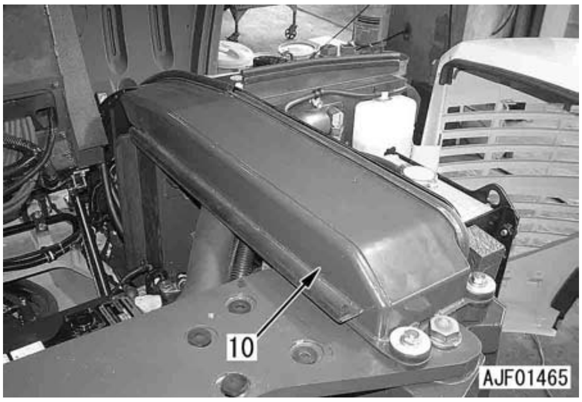
4. Open cover (7) and remove cover (8).



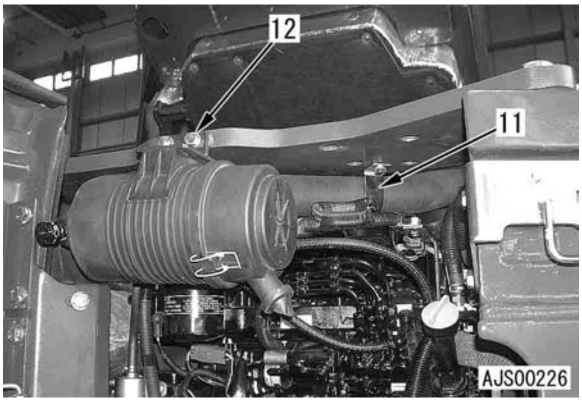
5. Remove working lamp wiring harness connector (9) from the bracket on the left side of the battery.



6. Remove cover (10).

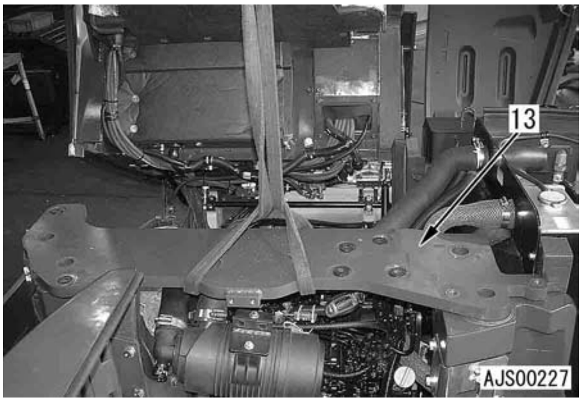


7. Remove clamp (11) and 2 air cleaner case mounting bolts (12).

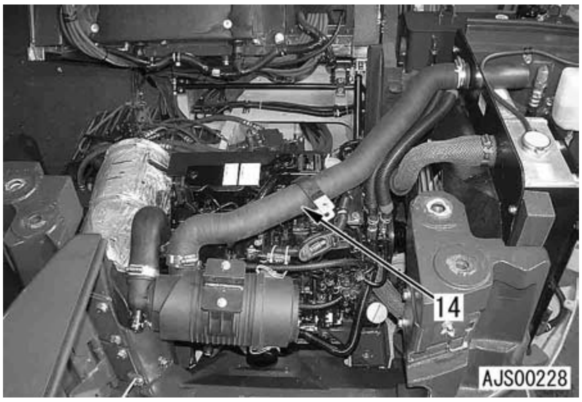


8. Remove plate (13).

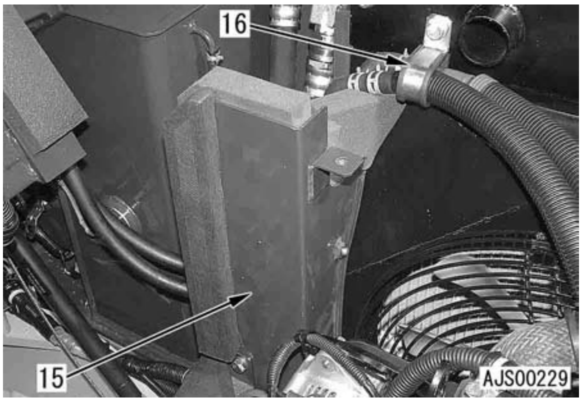
   Plate: **45 kg**



9. Remove air cleaner case and hose assembly (14). [*1]

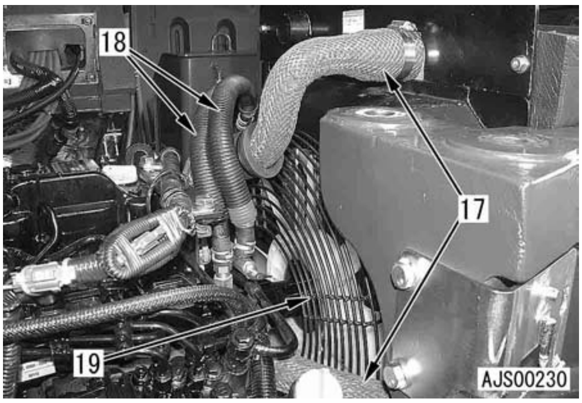


10. Remove cover (15) and clamp (16).



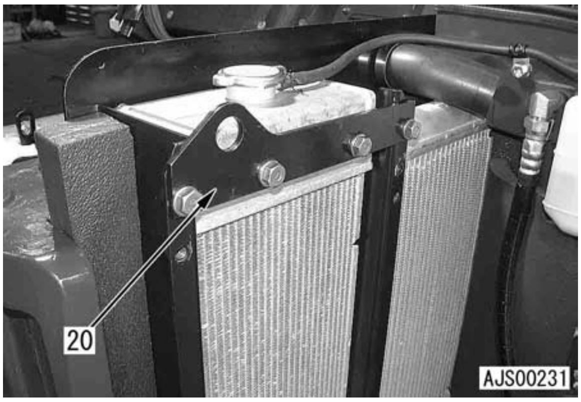
11. Disconnect radiator hose (17) and heater hose (18). [*2]

12. Remove fan guard (19).

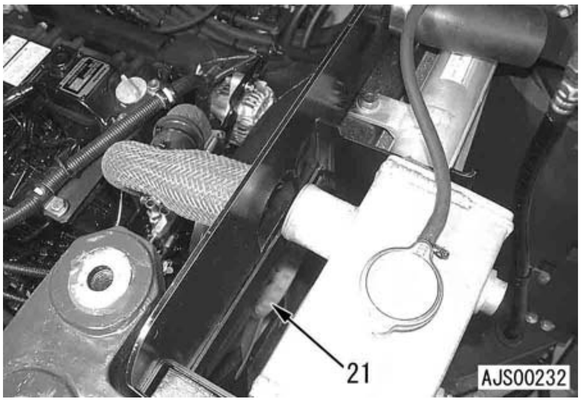


13. Remove alternator belt. [*3]

14. Remove plate (20).

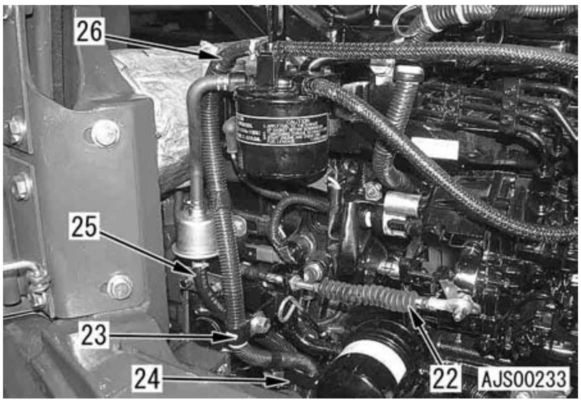


15. While leaning the radiator, remove cooling fan (21).
   ★ Return the radiator.



16. Remove fuel control cable (22). [*4]

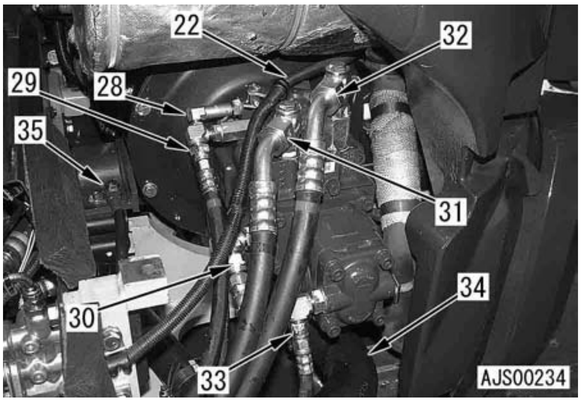
17. Remove clamps (23) and (24) and disconnect fuel hoses (25) and (26).
   ★ Plug the hoses to prevent fuel from leaking through them.



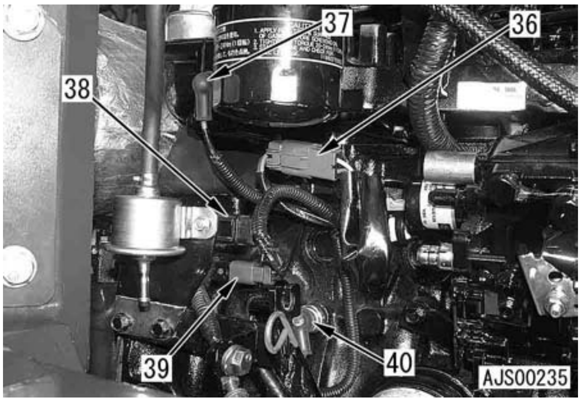
18. Remove and shift the clamp of fuel control cable (22).

19. Disconnect hoses (28) – (34) from the hydraulic pump.

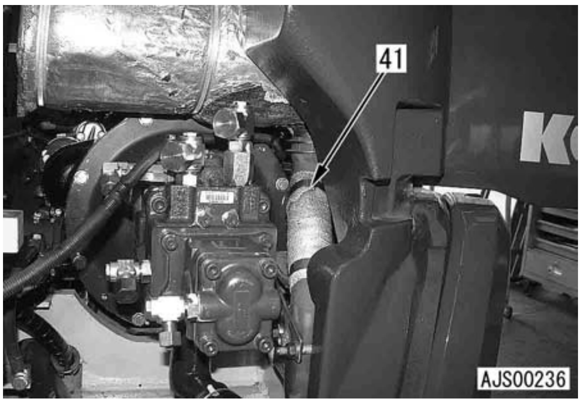
20. Disconnect ground cable (35).



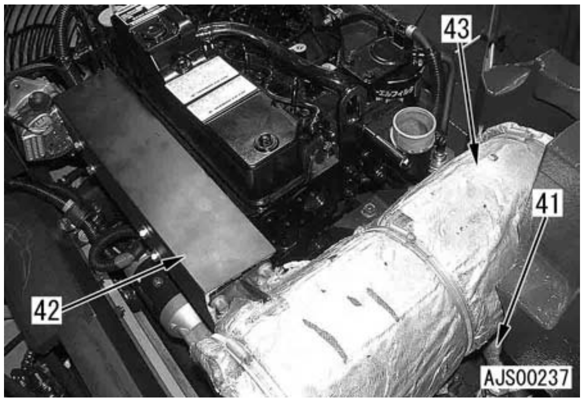
21. Disconnect connectors and terminals (36) – (40).



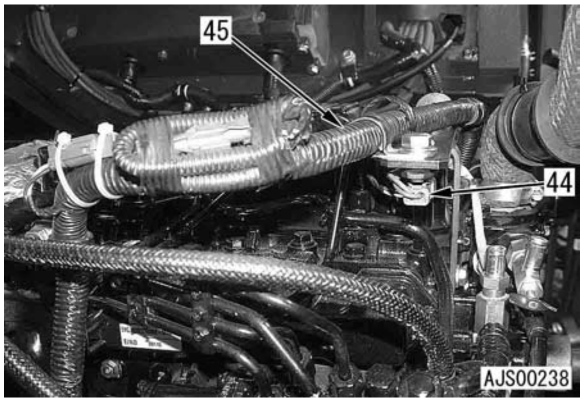
22. Remove the mounting bolts and clamp of exhaust tube (41).



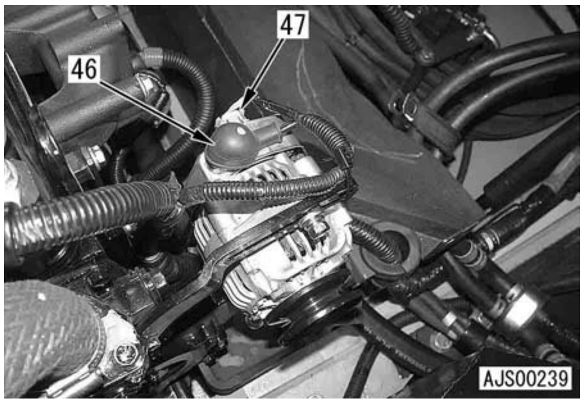
23. Remove exhaust manifold cover (42), muffler (43), and exhaust tube (41). [*5]



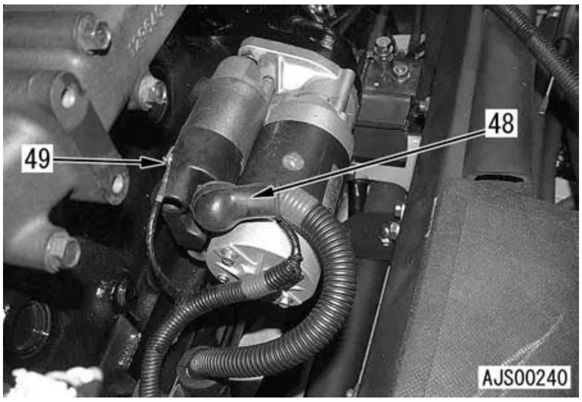
24. Disconnect connector (44) and shift wiring harness (45).



25. Disconnect terminal (46) and connector (47) from the alternator.

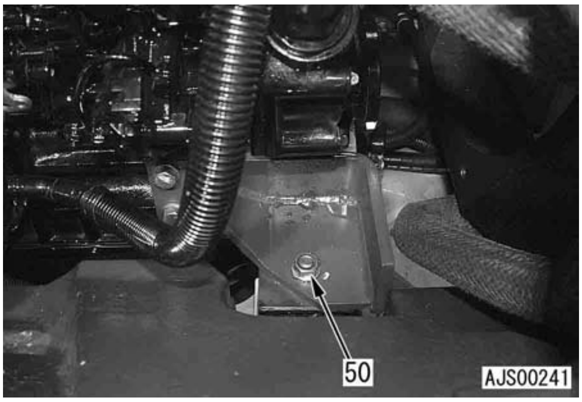


26. Disconnect terminals (48) and (49) from the starting motor.



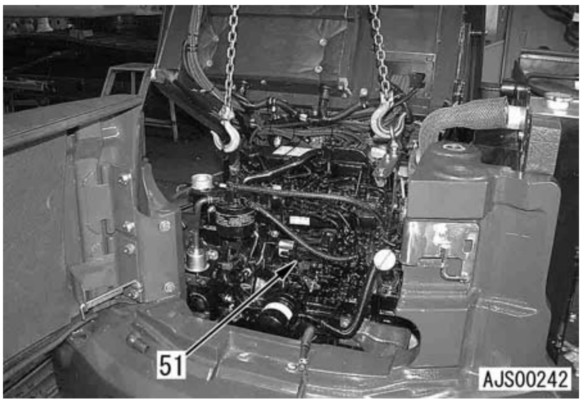
27. Sling the engine and hydraulic pump assembly temporarily.

28. Remove 4 mounting nuts (50). [*6]



29. Lift off engine and hydraulic pump assembly (51).
    ★ Check that all the wires and pipes have been disconnected.
    ★ When removing the engine and hydraulic pump assembly, take care that it will not interfere with other parts.

    Engine and hydraulic pump assembly: **250 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*2]

Radiator hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*3]

★ Adjust the belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting alternator belt tension.

[*4]

★ Adjust the cable tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel control lever.

[*5]

Muffler bracket mounting bolt: **Adhesive (LT-2)**

Muffler bracket mounting bolt: **59 – 74 Nm {6 – 7.5 kgm}**

[*6]

Mounting nut: **Adhesive (LT-2)**

Mounting nut: **59 – 74 Nm {6 – 7.5 kgm}**

- **Refilling with water**

★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again.

Coolant: **7.3 ℓ**

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Hydraulic oil: **20 ℓ (EO10-DH)**

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

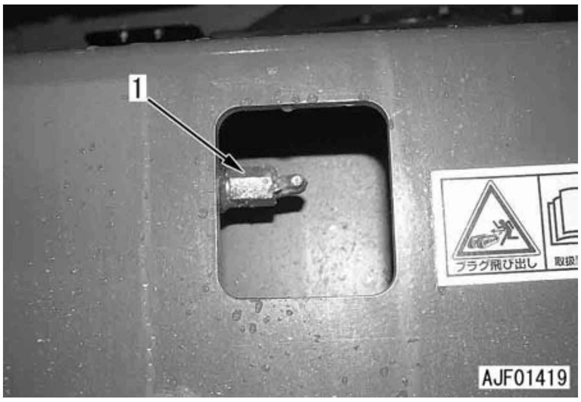
REMOVAL AND INSTALLATION OF TRACK SHOE ASSEMBLY

REMOVAL

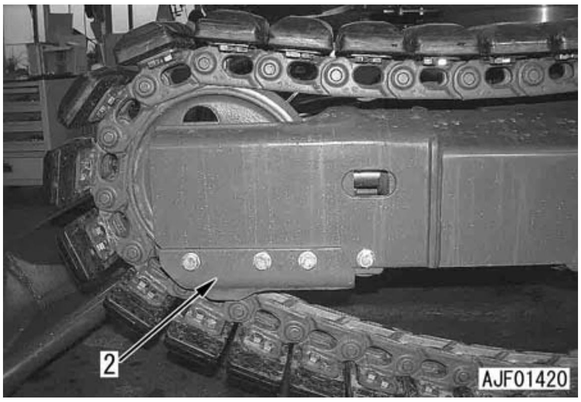
1. Swing the upper structure by 180° and raise the machine by using the work equipment and blade.

2. Loosen valve (1) to discharge grease and loosen the track shoe tension. [*1]

   Since valve (1) may jump out because of the high-pressure grease, do not loosen it more than 1 turn.



3. Remove cover (2).



4. Sling track shoe assembly (3) and pull it out toward this side.

   Rubber shoe
   PC27MR-2: **120 kg**
   PC30, 35MR-2: **130 kg**
   PC40, 50MR-2: **250 kg**

   Double grouser shoe
   PC27MR-2: **160 kg**
   PC30, 35MR-2: **170 kg**
   PC40, 50MR-2: **280 kg**

   Triple grouser shoe
   PC40, 50MR-2: **280 kg**

   Road liner
   PC27MR-2: **180 kg**
   PC30, 35MR-2: **190 kg**
   PC40, 50MR-2: **290 kg**

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

DISASSEMBLY AND ASSEMBLY OF IDLER ASSEMBLY

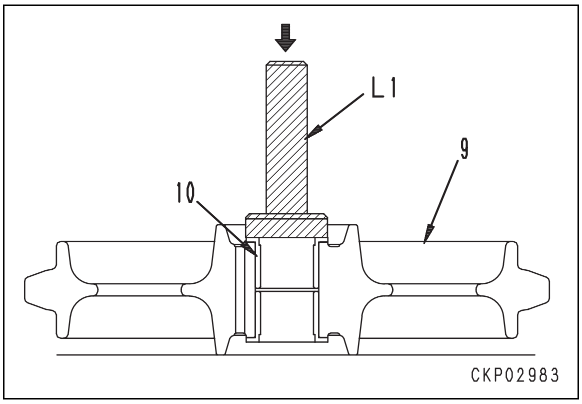
SPECIAL TOOLS

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L	1	790-101-5001	Push tool KIT	●	1		
		790-101-5081	• Plate		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
	2	791-430-3230	Installer	■	1		

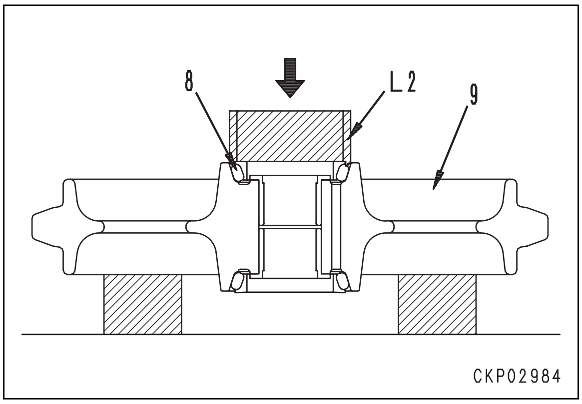
★ In this section, only the assembly procedure is explained.

ASSEMBLY

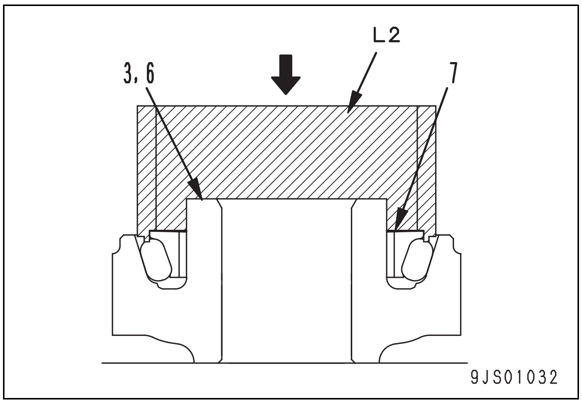
1. Using tool **L1**, press fit 2 bushings (10) to idler (9).



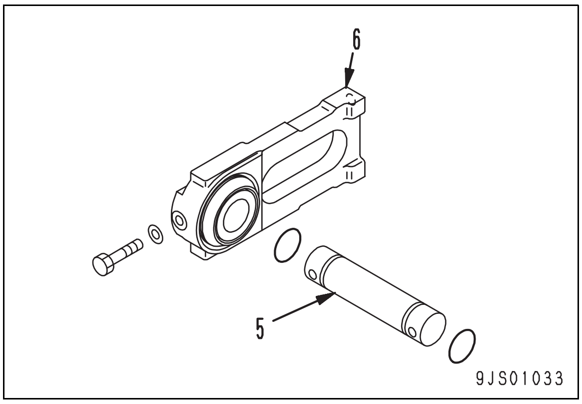
2. Using tool **L2**, install 2 floating seals (8) to idler (9).
   ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.
   ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.



3. Using tool **L2**, install floating seals (7) to support (3) and (6).
   ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.
   ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.



4. Fit O-ring and install shaft (5) to support (6).



5. Install support and shaft assembly (4) to idler.

6. Fill inside of idler with engine oil.

   Inside portion of idler :
   Approx. 20 cc (EO30-CD)

7. Install support (3).

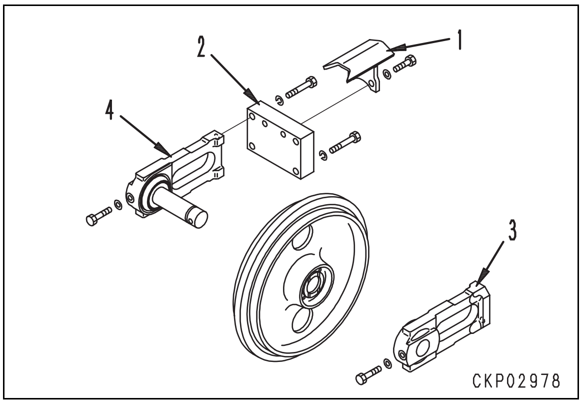
   Mounting bolt : **Thread tighener (LT-2)**

8. Install bracket (2).

   Mounting bolt : **Thread tighener (LT-2)**

   Mounting bolt :
   98 – 123 Nm {10.0 – 12.5 kgm}

9. Install cover (1).
   (This steps is not necessary for PC27MR-2)



DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING ASSEMBLY

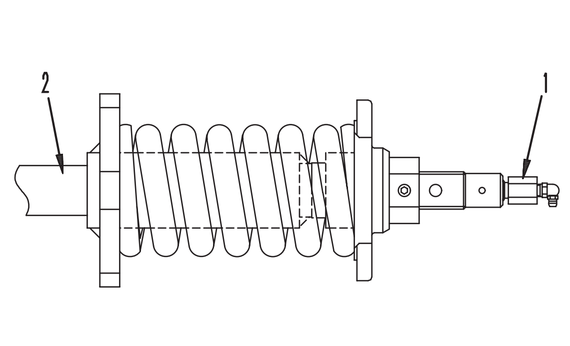
SPECIAL TOOLS

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
M	792-371-1400	Sleeve	■	1		

DISASSEMBLY

1. Piston

1) Remove valve (1).
2) Remove piston (2).



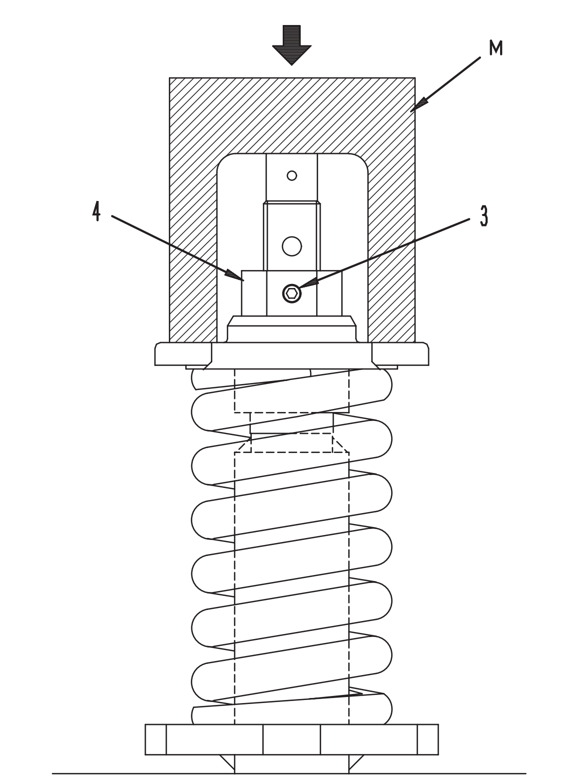
CKP02986

2. Recoil spring

1) Using tool **M**, set recoil spring to press.

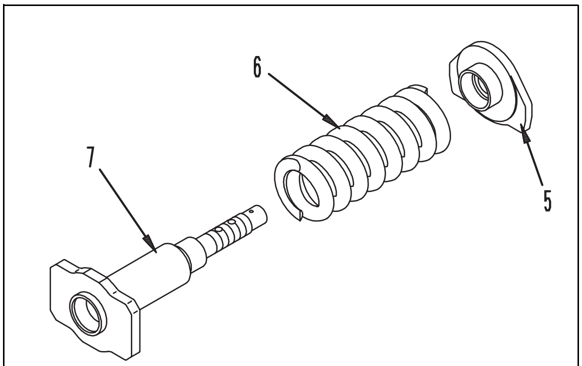
⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.

2) Apply hydraulic pressure slowly to compress spring, then remove screw (3) and remove nut (4).
   - ★ Compress the spring to a point where the nut becomes loose.
   - ★ Installed load of spring:
     PC27, 30, 35MR-2: 30.9 kN {3,153 kgm}
     PC40, 50MR-2
     Rubber shoe specification:
     42.4 kN {4,326 kgm}
     Steel, road liner specification:
     26.9 kN {2,748 kgm}



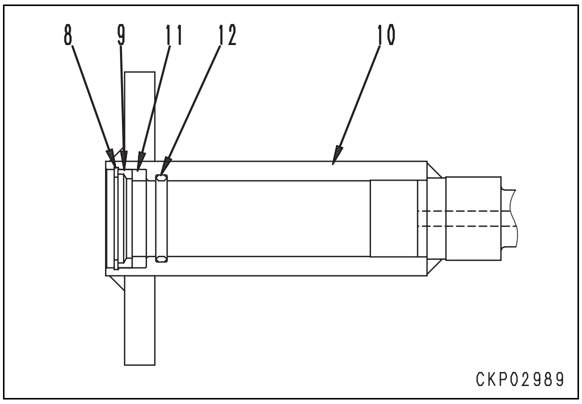
CKP02987

3) Release the hydraulic pressure slowly and allow spring to extend, then remove stopper (5) and spring (6) from cylinder assembly (7).
   - ★ Free length of spring :
     PC27, 30, 35MR-2: 257 mm
     PC40, 50MR-2: 302 mm



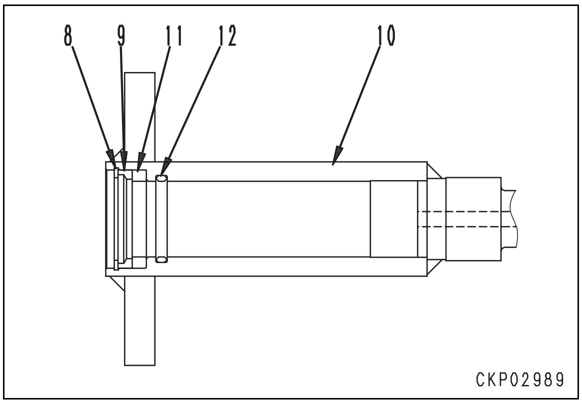
CKP02988

3. Cylinder
1) Remove snap ring (8), then remove spacer (9) from cylinder (10).
2) Remove dust seal (11)
3) Remove O-ring (12).

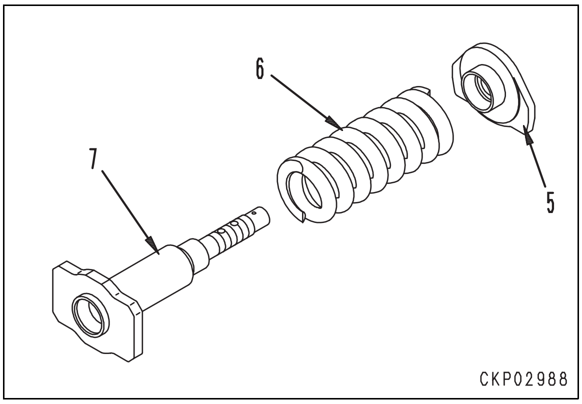


ASSEMBLY

1. cylinder
1) Install O-ring (12) to cylinder (10).
2) Install dust seal (11).
3) Fit spacer (9) and secure with snap ring (8).



2. Recoil spring
1) Assemble cylinder assembly (7), spring (6), and stopper (5).



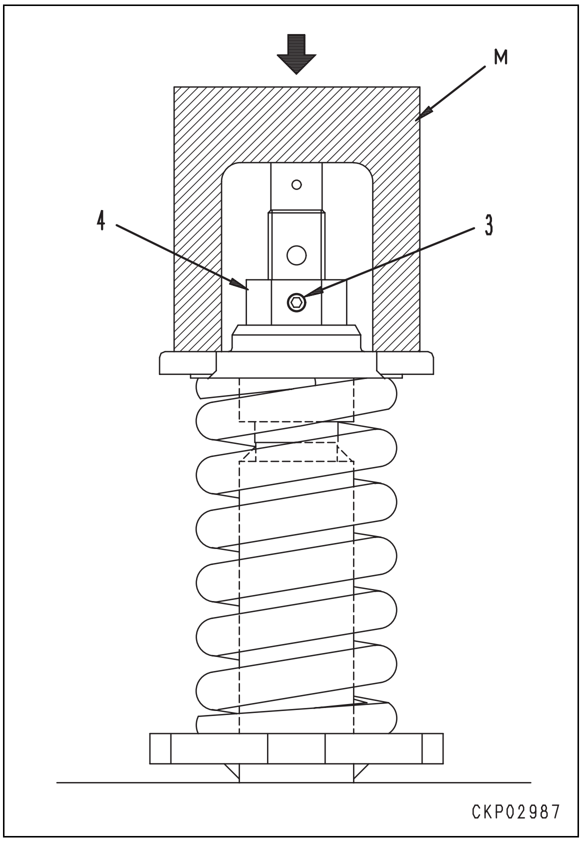
2) Using tool **M**, set recoil spring to press.

⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.

3) Apply hydraulic pressure slowly to compress spring, then fit nut (4) and install screw (3).

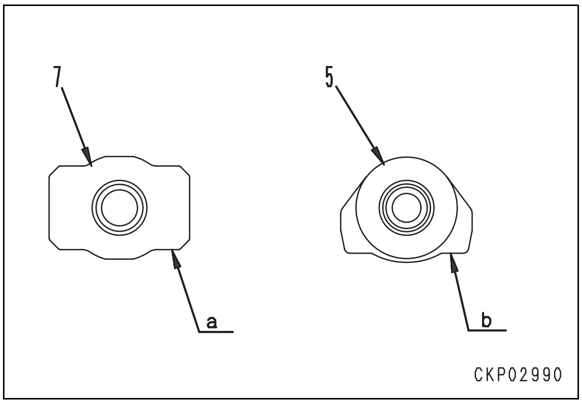
★ Installed height of spring:
PC27, 30, 35MR-2: 188 mm
PC40, 50MR-2
Rubber shoe specification: 202.2 mm
Steel, road liner specification: 238.2 mm

★ Installed height of spring:
PC27, 30, 35MR-2: 30.9 kN {3,153 kgm}
PC40, 50MR-2
Rubber shoe specification:
42.4 kN {4,326 kgm}
Steel, road liner specification:
26.9 kN {2,748 kgm}



★ After assembling the recoil spring, check that the out-of -parallel between surface **a** of cylinder (7) and surface **b** of stopper (5) is less than 0.5 mm.

★ The figure shows PC27, 30, 35MR-2 as an example.



3. Piston

1) Tighten plug (1) temporarily.

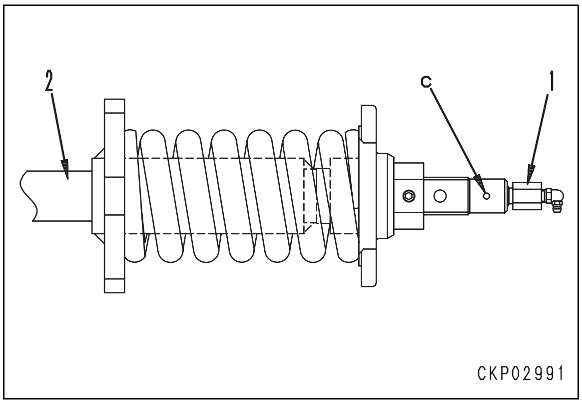
★ Grease will come out from grease hole c, so tighten completely, then turn back approx. 2 turns.

2) Add approx. 120 cc of grease (G2-LI) inside cylinder.

3) Assembly cylinder (2) and push in until grease come out from grease hole **c**.

4) When grease come out, tighten valve (1).

★ After tightening the valve, check that the grease fitting is facing the outside (just beside) of the chassis.



DISASSEMBLY AND ASSEMBLY OF TRACK ROLLER ASSEMBLY

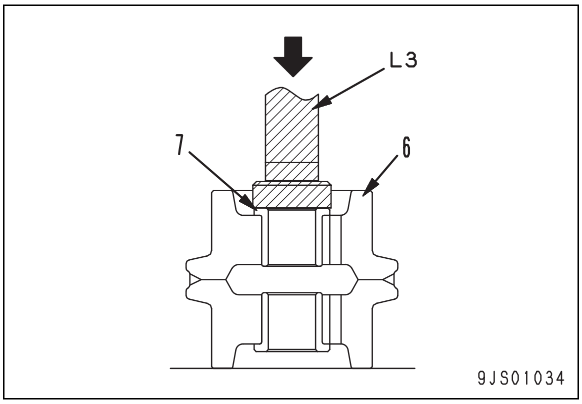
SPECIAL TOOLS

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L	3	790-101-5001	Push tool KIT	●	1		
		790-101-5051	• Plate (PC27, 30, 35MR-2)		1		
		790-101-5081	• Plate (PC40, 50MR-2)		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
	4	791-434-1660	Installer (PC27, 30, 35MR-2)	■	1		
		791-430-3230	Installer (PC40, 50MR-2)	■	1		

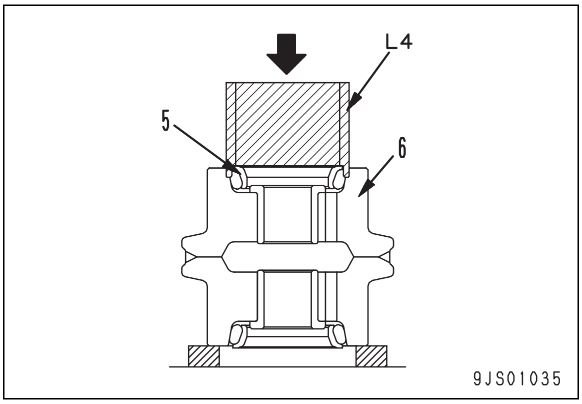
★ In this section, only the assembly procedure is explained.

ASSEMBLY

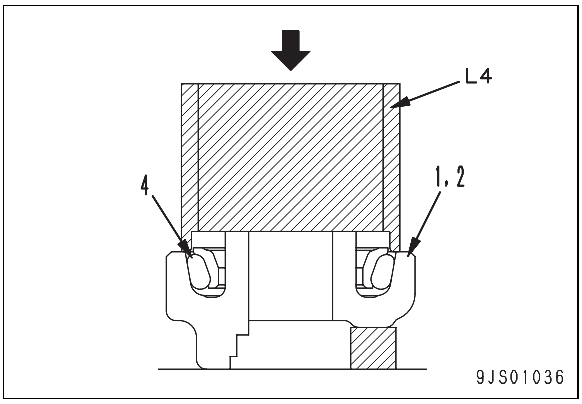
1. Press fit two pieces of the bushing (7) in the roller (6) using the tool **L3**.



2. Set two pieces of the floating seal (5) in the roller (6) using the tool **L4**.
   ★ Clean the O-ring and the O-ring contact surface to degrease completely and dry them.
   ★ Apply engine oil (EO30-CD) to the floating seal sliding surface and keep it free from dust.



3. Set the floating seal (4) in the collars (1) and (2) by using the tool **L4**.
   ★ Clean the O-ring and the O-ring contact surface to degrease completely and dry them.
   ★ Apply engine oil (EO30-CD) to the floating seal sliding surface and keep it free from dust.



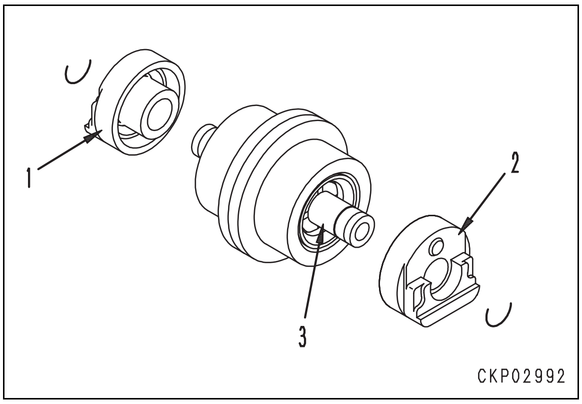
4. Set the O-ring and install the shaft (3) in the roller.

5. Set the collar (2) on the roller and fix it with a snap ring.

6. Fill engine oil in the roller.

   Roller inside:
   PC27, 30, 35MR-2: **Approx. 50cc (EO30-CD)**
   PC40, 50MR-2: **Approx. 135cc (EO30-CD)**

7. Set the collar (1) on the roller and fix it with a snap ring.



DISASSEMBLY AND ASSEMBLY OF CARRIER ROLLER ASSEMBLY

SPECIAL TOOLS

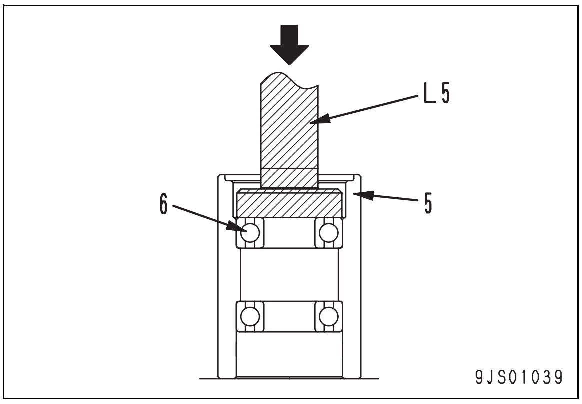
Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L	5	790-101-5001	Push tool KIT	●	1		
		790-101-5081	• Plate		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
	6	790-101-5001	Push tool KIT	●	1		
		790-101-5111	• Plate		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		

★ In this section, only the assembly procedure is explained.

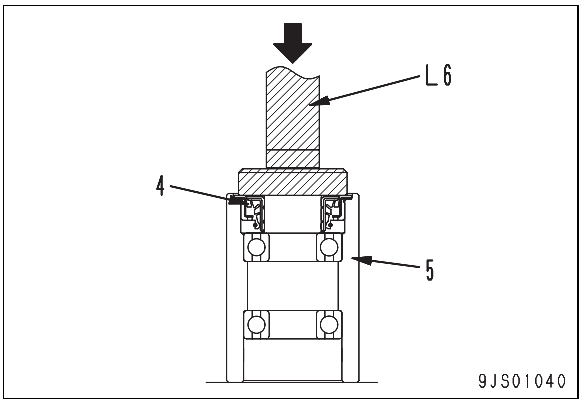
ASSEMBLY

1. Using tool **L5**, press fit 2 ball bearings (6) to roller (5).

   Fill the ball portion of the bearing with grease (**Alvania EP or equivalent**)



2. Using tool **L6**, press fit dust seal (4) to roller (5).

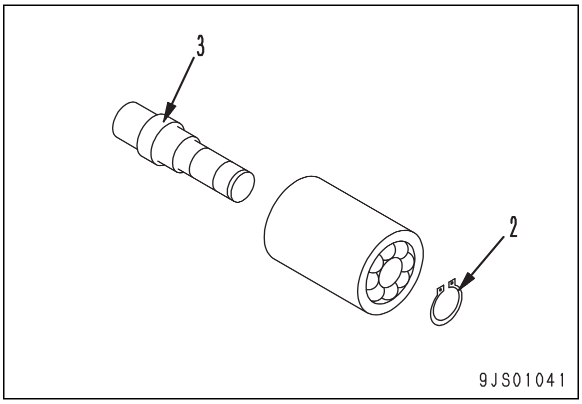


3. Fill the inside of the roller with grease.

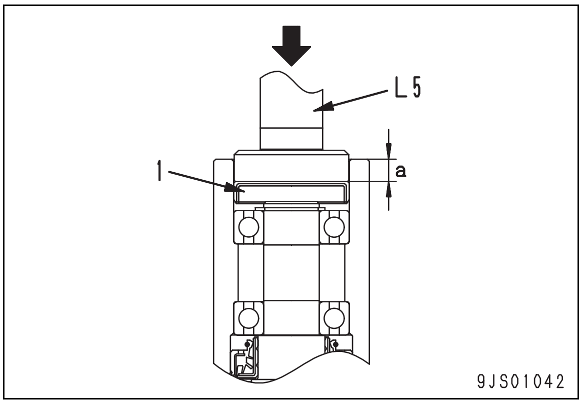
   Inside portion of roller :
   Approx. 30 cc (Alvania EP or equivalent)

4. Install shaft (3) to roller.

5. Using snap ring pliers, install snap ring (2).
   ★ Install the snap ring so that the edge on the inside faces the tip of the shaft.



6. Using tool **L5**, press fit cap (1).
   ★ Cap press-fitting depth **a** : 10 mm



REMOVAL AND INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

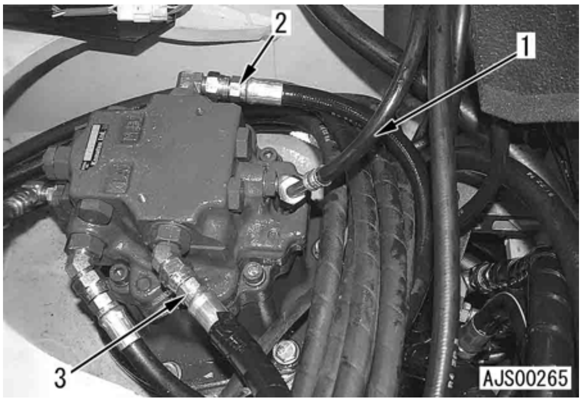
PC27, 30, 35MR-2

REMOVAL

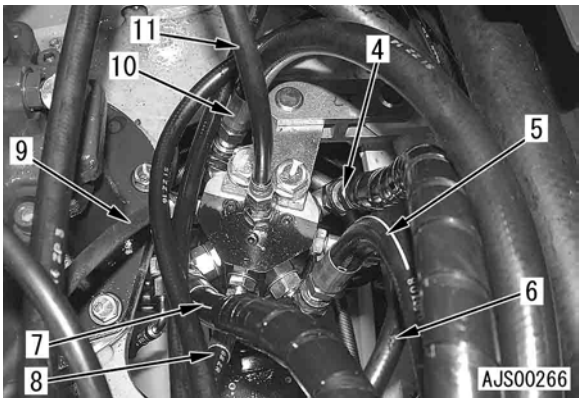
1. Release the air pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing air in hydraulic tank.

2. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

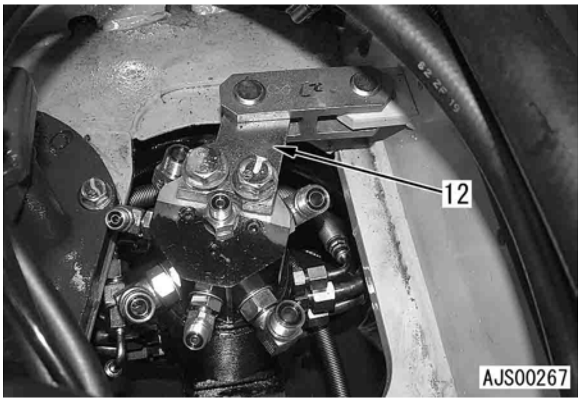
3. Disconnect hoses (1), (2), and (3) from the swing motor. Move the hoses above the center swivel joint together toward the swing motor.



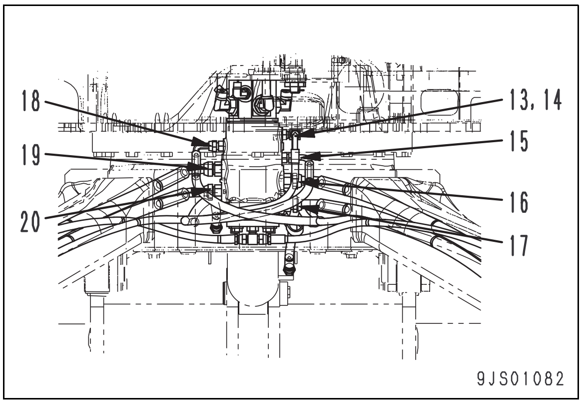
4. Disconnect hoses (4) – (11).



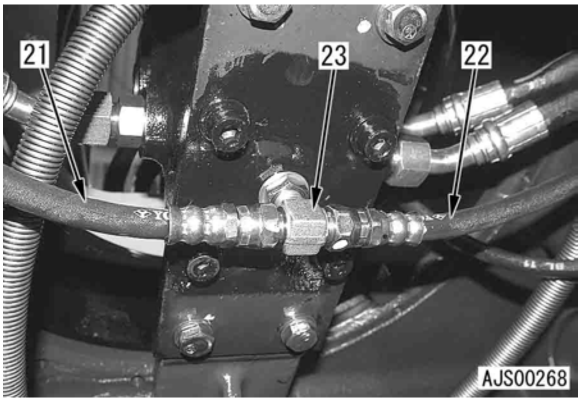
5. Remove lever (12) from the center swivel joint. [*1]



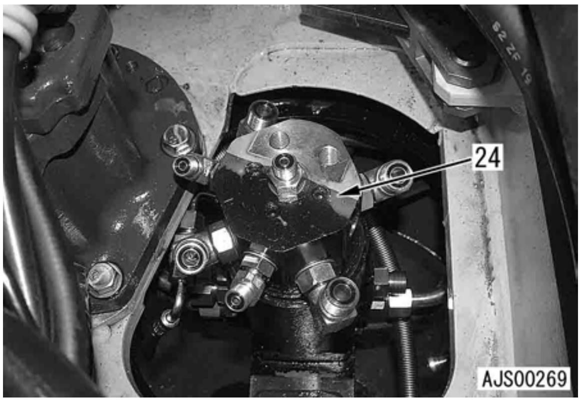
6. Disconnect hoses (13) – (20).



7. Disconnect hoses (21) and (22) and remove elbow (23).



8. Remove center swivel joint assembly (24).



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Lever mounting bolt: **Adhesive (LT-2)**

Lever mounting bolt:
153 – 190 Nm {15.5 – 19.5 kgm}

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

PC40, 50MR-2

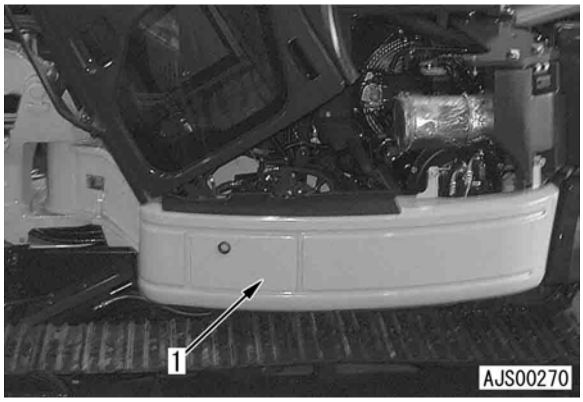
REMOVAL

1. Release the air pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing air in hydraulic tank.

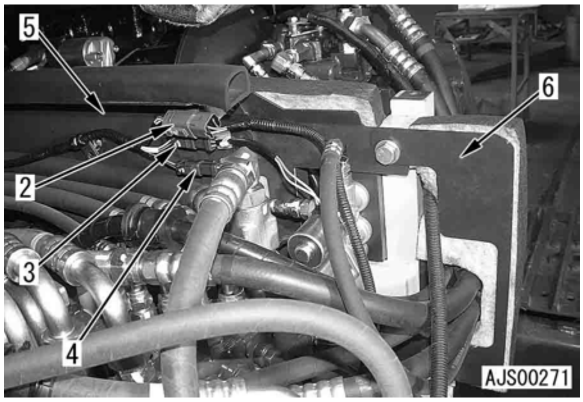
2. Tilt up the floor frame. For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

   ⚠ Disconnect the cable from the negative (–) terminal of the battery.

3. Remove left side cover (1).

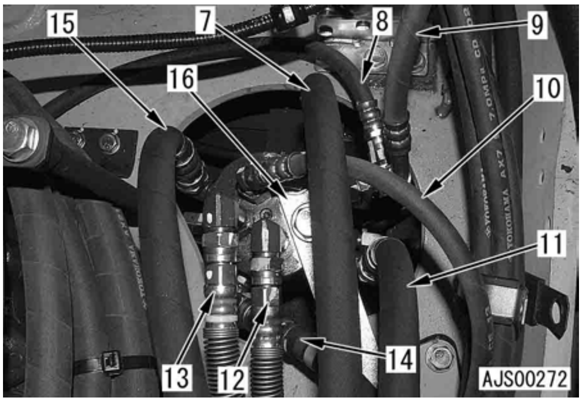


4. Remove connectors (2), (3), and (4) from the bracket, and then remove covers (5) and (6).

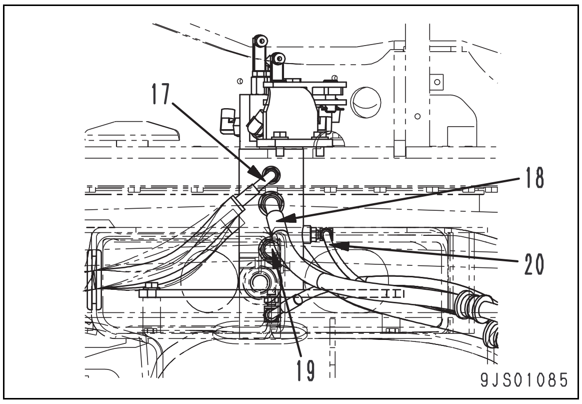


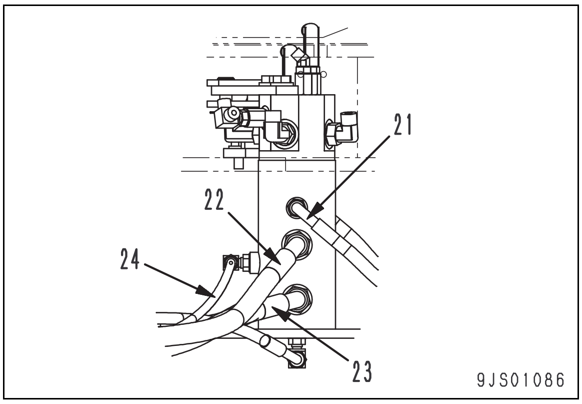
5. Disconnect hoses (7) – (15).

6. Remove lever (16) from the center swivel joint. [*1]



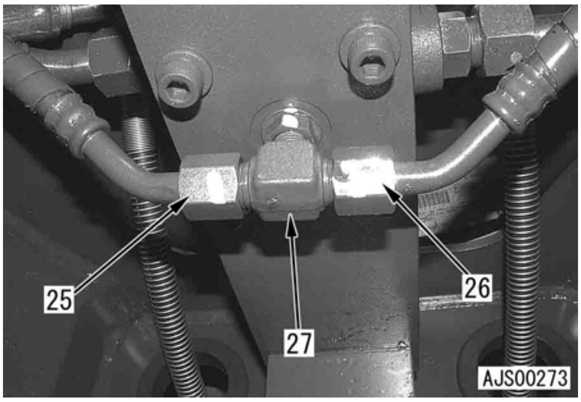
7. Disconnect hoses (17) – (24).





8. Disconnect hoses (25) and (26).

9. Remove elbow (27) and center swivel joint assembly.



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Lever mounting bolt: **Adhesive (LT-2)**

Lever mounting bolt: **153 – 190 Nm {15.5 – 19.5 kgm}**

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

DISASSEMBLY AND ASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

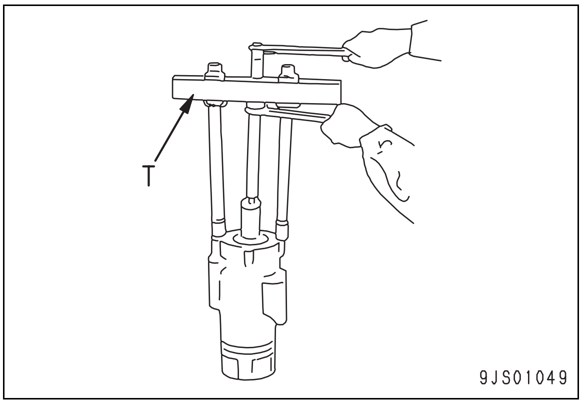
SPECIAL TOOLS

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
T	790-101-2501	Push puller	●	1		
	790-101-2510	• Block		1		
	790-101-2520	• Screw		1		
	791-112-1180	• Nut		1		
	790-101-2540	• Washer		1		
	790-101-2630	• Leg		2		
	790-101-2570	• Plate		4		
	790-101-2560	• Nut		2		
	790-101-2660	• Adapter		2		

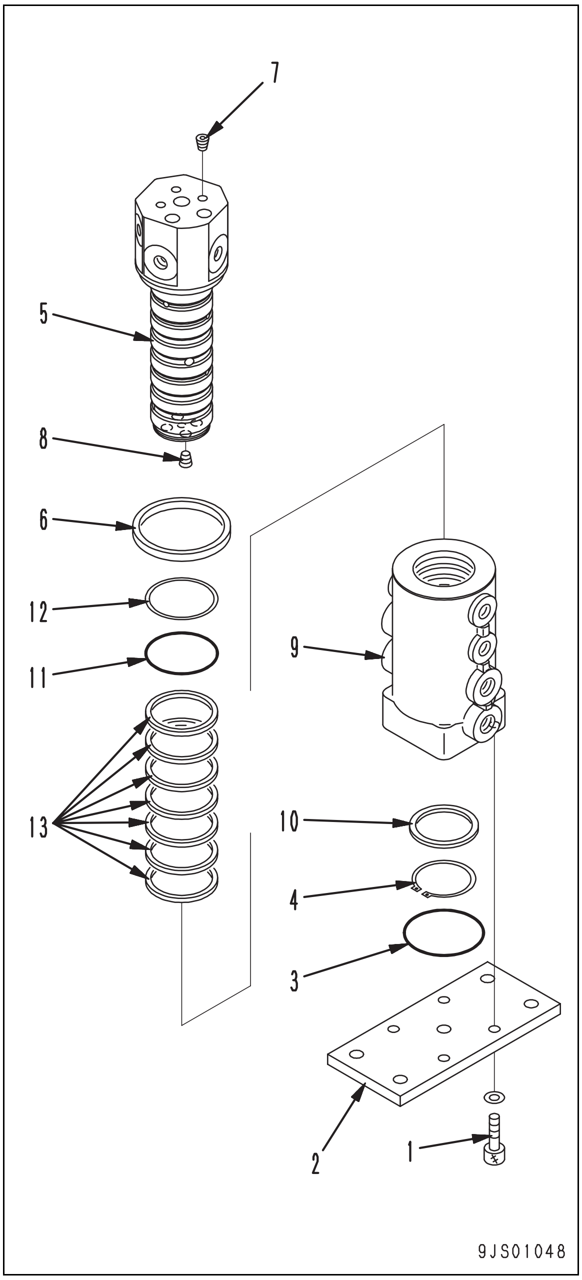
★ The figures in this section show PC27, 30, 35MR-2. Although PC40, 50MR-2 has dimensions and shapes a little different from these figures, the disassembly and assembly procedures are the same.

DISASSEMBLY

1. Remove bolts (1) and plate (2).
2. Remove O-ring (3) and snap ring (4).
3. Using tool **T**, pull rotor (9) out of swivel shaft (5).



4. Remove dust seal (6), 3 plugs (7), and 4 plugs (8) from the swivel shaft (5).
   ★ PC40, 50MR-2 has 1 plug (7) at the center.
5. Remove ring (10), O-ring (11), backup ring (12), and 7 slipper seals (13) from rotor (9).
   ★ Only PC27, 30, 35MR-2 has backup ring (12).
   ★ PC40, 50MR-2 has 8 slipper seals (13).



ASSEMBLY

1. Install O-ring (11), backup ring (12), and 7 slipper seals (13) to rotor (9).
   ★ Install backup ring (12) to only PC27, 30, 35MR-2.
   ★ PC40, 50MR-2 has 8 slipper seals (13).

2. Install dust seal (6) to swivel shaft (5).

   Dust seal lip: **Grease (G2-LI)**

3. Install 3 plugs (7) and 4 plugs (8) to swivel shaft (5).
   ★ PC40, 50MR-2 has 1 plug (7) at the center.
   ★ Degrease, clean, and dry the threaded parts sufficiently.
   ★ After installing, check that the plug ends are lower than the shaft end.

   Plug (8)
   PC27MR-2:
   16.7 ± 2.9 Nm {1.7 ± 0.3 kgm}
   PC30, 35MR-2:
   33.3 ± 3.9 Nm {3.4 ± 0.4 kgm}
   PC40, 50MR-2:
   32 ± 13 Nm {3.3 ± 1.3 kgm}

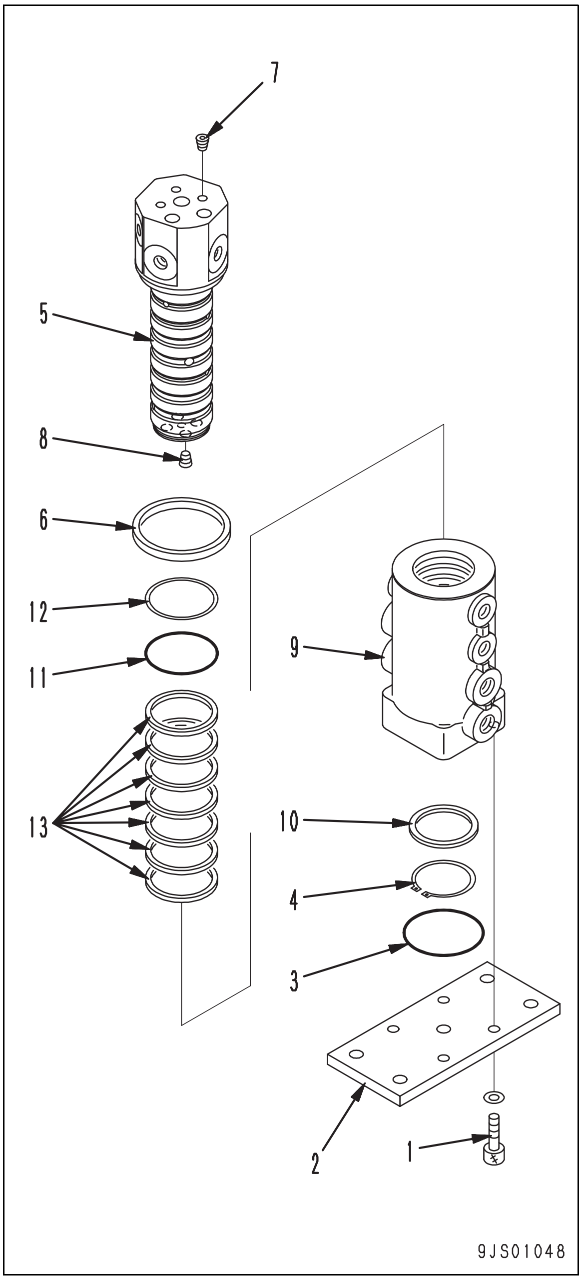
4. Set swivel shaft (5) to the block. Using the push tool and hitting with a plastic hammer, etc., install rotor (9).
   ★ Take care extremely not to damage the slipper seals and O-ring.

   Contact surfaces of rotor and swivel shaft: **Grease (G2-LI)**

5. Install ring (10), snap ring (4), and O-ring (3).

6. Install plate (2).

   Mounting bolt (1)
   PC27MR-2:
   11.8 – 14.7 Nm {1.2 – 1.5kgm}
   PC30, 35, 40, 50MR-2:
   66 ± 7 Nm {6.7 ± 0.7 kgm}



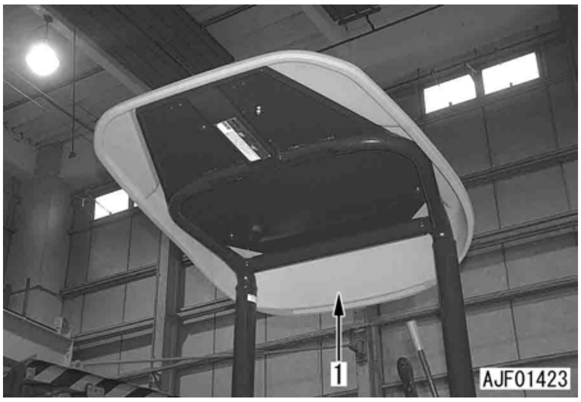
REMOVAL AND INSTALLATION OF FLOOR FRAME ASSEMBLY

REMOVAL

⚠ Disconnect the cable from the negative (–) terminal of the battery.

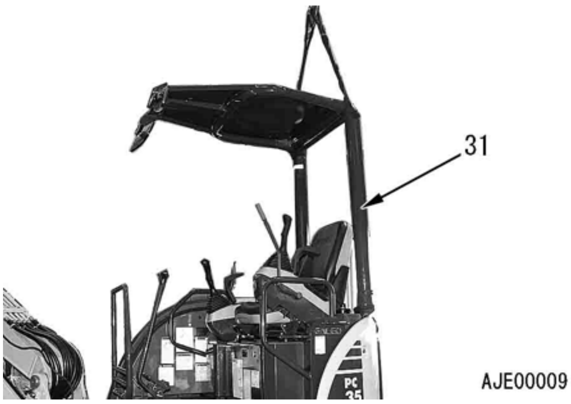
1. Release the air pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing air in hydraulic tank.

2. Remove roof (1).
   ★ Perform this step for only the model with the canopy specification.

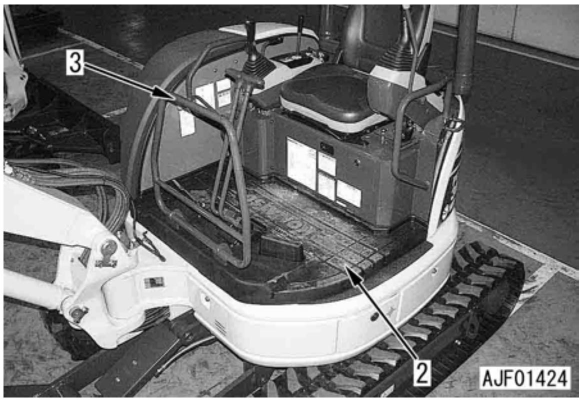


3. Lift off canopy (31).
   (Only for PC35MR-2, Serial No. 9242 and up for North America)

   Canopy **77 kg**

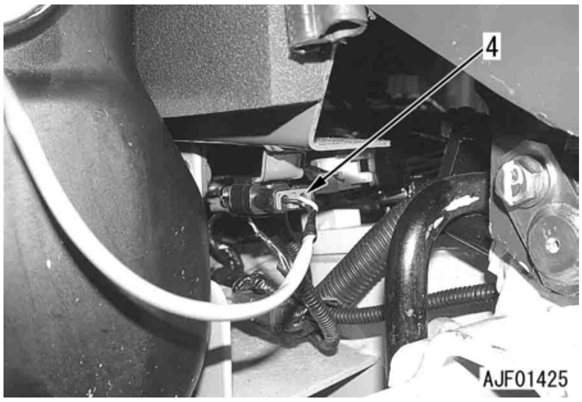


4. Remove floor mat (2) and bar (3).
   ★ Perform this step for only the model with the canopy specification.

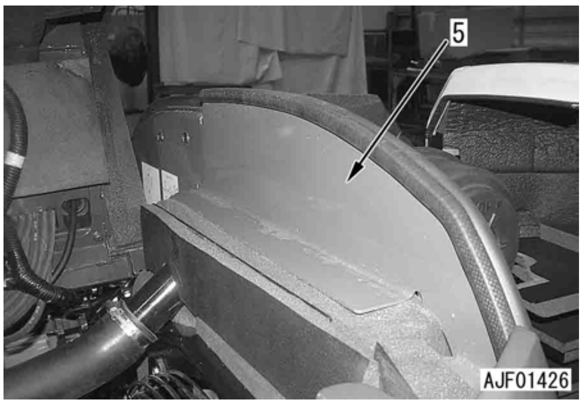


5. Tilt up the floor frame.
   For details, see TESTING AND ADJUSTING, How to open and close (tilt) floor.

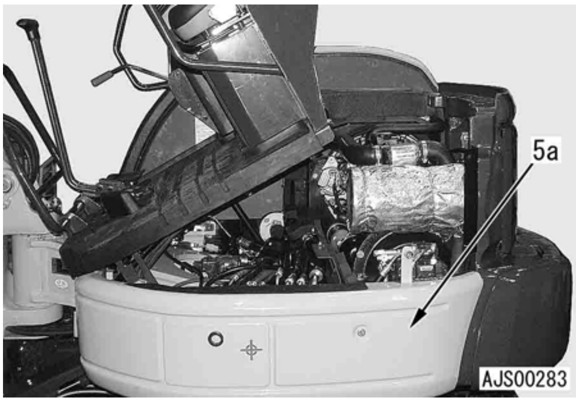
6. Open the top cover of the fuel tank. Disconnect and remove fuel level gauge connector (4) from the bracket.
   ★ Perform this step for only PC27, 30, 35MR-2.



7. Open the right side cover. Remove all the mounting bolts of plate (5) on the right side of the engine, and then raise the plate toward the front of the machine and secure it with ropes, etc.
   ★ Perform this step for only PC27, 30, 35MR-2.

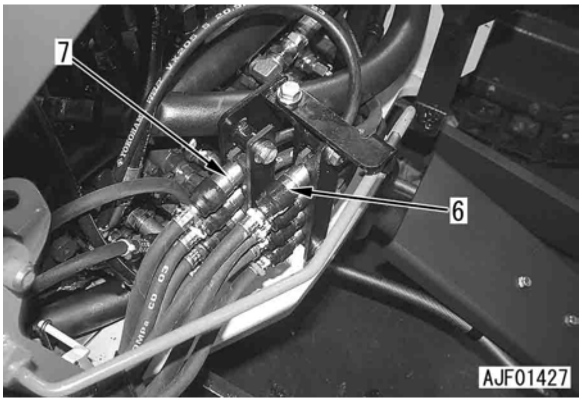


8. Remove cover (5a).



9. Remove work equipment PPC hoses (6) and (7), 8 pieces in total. [*1]
   ★ Hose band colors
   PC27MR-2:
   Hoses (6) on this side from above:
   Black, yellow, blue and red
   Hoses (7) on the deeper side from above:
   Brown, green, white and orange
   PC30, 35MR-2:
   Hoses (6) on this side from above:
   White, green, brown, and orange
   Hoses (7) on the deeper side from above:
   Blue, yellow, red, and black

   PC40, 50MR-2:
   Hoses (6) on this side from above:
   Brown, green, white, and orange
   Hoses (7) on the deeper side from above:
   Blue, yellow, red, and black

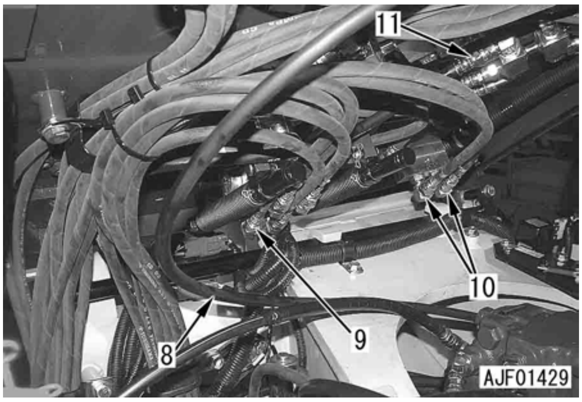


10. Disconnect fuel control cable (8) from the engine and pull it out toward the front of the engine. [*2]
    ★ Check the route of the cable.

11. Disconnect 4 travel PPC hoses (9). [*3]
    ★ Identification type colors of hoses
    (PC27MR-2): Right front: "Black, yellow"
    Right rear: "Yellow, green"
    Left front: "Yellow, brown"
    Left rear: "Yellow, orange"
    ★ Identification marks of hoses
    (PC30, 35MR-2): Right front: "1"
    Right rear: "2"
    Left front: "3"
    Left rear: "4"
    ★ Identification tape colors of hoses
    (PC40, 50MR-2): Right front: "Black, yellow"
    Right rear: "Green, yellow"
    Left front: "Brown, yellow"
    Left rear: "Yellow"

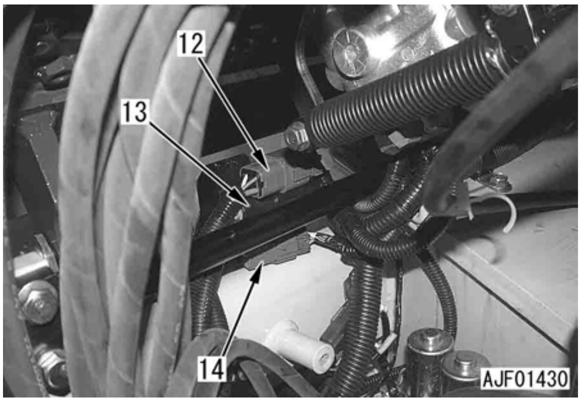
12. Disconnect 2 swing PPC hoses (10). [*4]
    ★ Identification tape colors of hoses
    (PC27MR-2): Right side: "Blue, white"
    Left side: "Red, white"
    ★ Identification marks of hoses
    (PC30, 35MR-2): Right side: "A"
    Left side: "B"
    ★ Identification tape colors of hoses
    (PC40, 50MR-2): Right side: "White, blue"
    Left side: "White, red"

13. Disconnect hose (11).

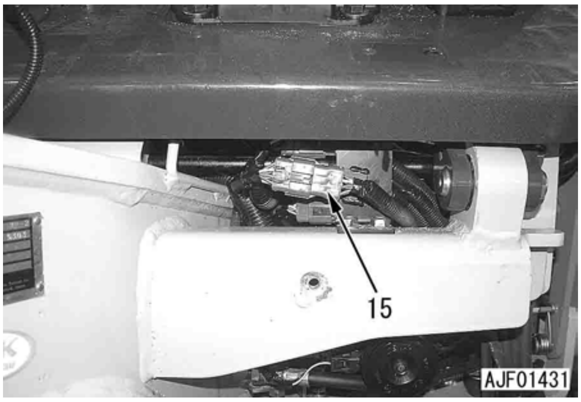


14. Disconnect connectors (12) – (15) in front of the revolving frame.

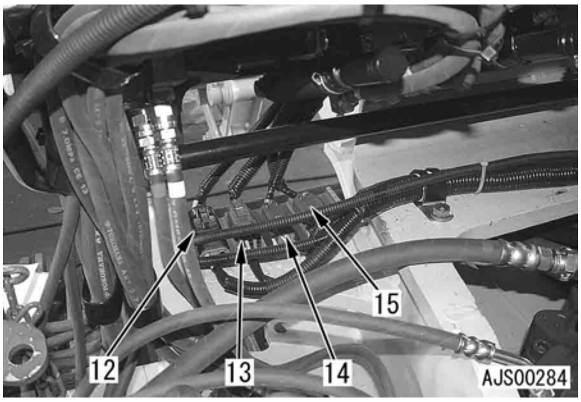
PC27, 30, 35MR-2



PC27, 30, 35MR-2



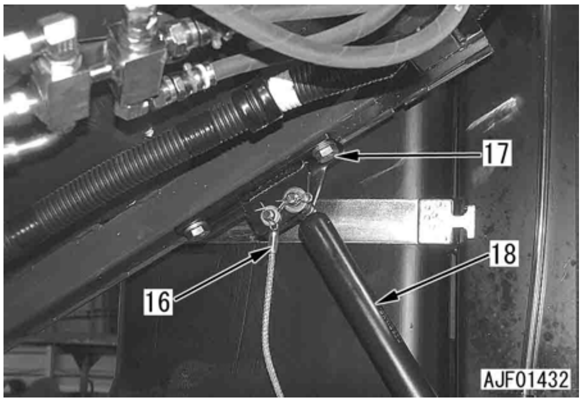
PC40, 50MR-2



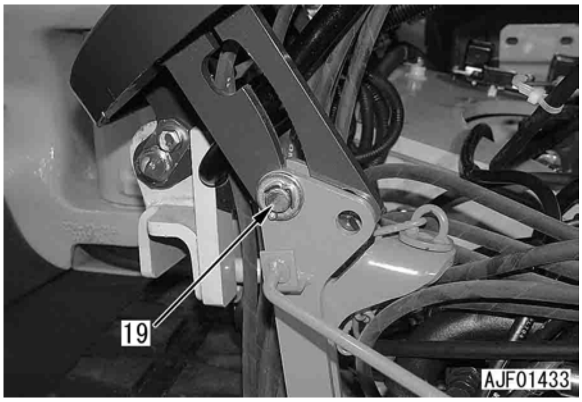
15. Sling the canopy and floor frame (operator's cab and floor frame) assembly temporarily.

16. Disconnect wire (16) from the floor frame.

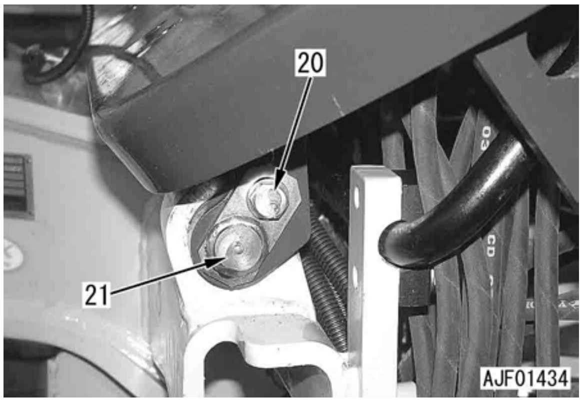
17. Loosen 2 bolts (17) gradually and alternately to disconnect damper (18).



18. Pull out pin (19).



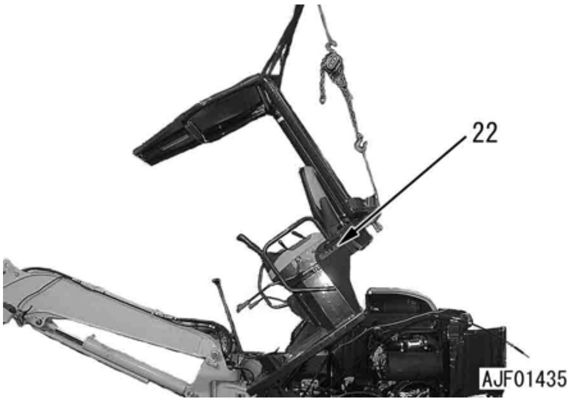
19. Remove right and left bolts (20) and pull out pin (21).



20. Lift off canopy and floor frame (operator's cab and floor frame) assembly (22).
(Except PC35MR-2, Serial No. 9242 and up for North America.)
   ★ Check that all the wires and pipes have been disconnected.
   ★ When removing the assembly, take care of its balance.
   ★ Do not remove the canopy singly.
   ★ The operator's cab and the floor frame are made in 1 unit.

   Canopy and floor frame assembly: **290 kg**
   Cab and floor frame assembly: **400 kg**

Canopy specification



Cab specification

21. Lift off floor frame assembly (23).
(For PC35MR-2 with the canopy spec., Serial No. 9242 and up for North America.)
   ★ Check that all the wires and pipes have been disconnected.
   ★ When removing the assembly, take care of its balance.

   Floor frame assembly: **60 kg**

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]
   ★ When connecting, check the identification colors.

[*2]
   ★ Adjust the cable tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel control lever.

[*3], [*4]
   ★ When connecting, check the identification marks and colors.

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

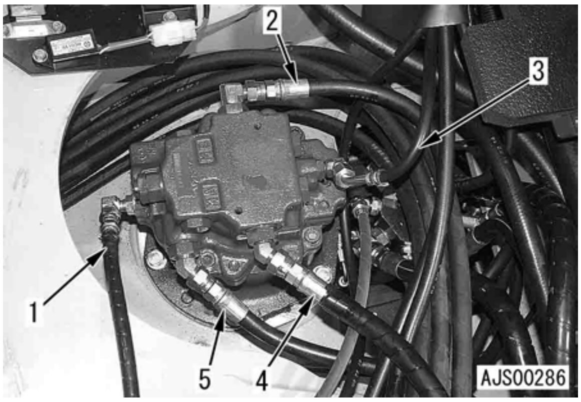
REMOVAL AND INSTALLATION OF SWING MOTOR AND SWING MACHINERY ASSEMBLY

REMOVAL

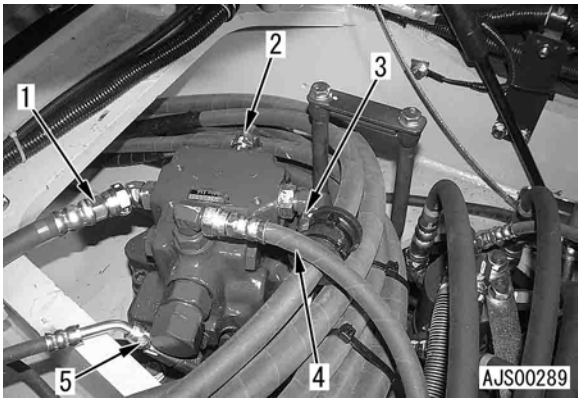
1. Remove the canopy and floor frame (operator's cab and floor frame) assembly. For details, see REMOVAL AND INSTALLATION OF FLOOR FRAME ASSEMBLY.

2. Disconnect hoses (1) – (5).
   ★ Shift the hoses on the side of the swing motor. (PC40, 50MR-2)

   PC27, 30, 35MR-2



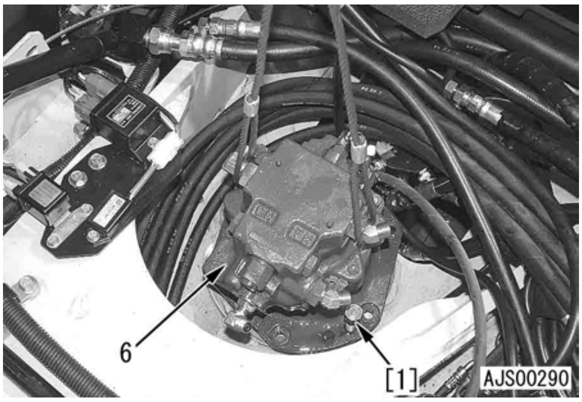
   PC40, 50MR-2



3. Remove all the mounting bolts and separate the swing machinery from the frame, using forcing screws [1] (2 pieces). [*1]

4. Lift off swing motor and swing machinery assembly (6).

   Swing motor and swing machinery assembly
   PC27, 30, 35MR-2: **35 kg**
   PC40, 50MR-2: **45 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

DISASSEMBLY AND ASSEMBLY OF SWING MOTOR AND SWING MACHINERY ASSEMBLY

SPECIAL TOOLS

PC27, 30, 35MR-2

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F	1	796T-126-1210	Wrench	■	1	N	○
	2	790-101-5001	Push tool KIT	■	1		
		790-101-5151	• Plate		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
	3	790-101-5201	Push tool KIT	●	1		
		790-101-5271	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	4	790-101-5201	Push tool KIT	●	1		
		790-101-5331	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	5	796-760-9110	Push tool	■	1		
	6	790-445-3810	Push tool	■	1		

PC40, 50MR-2

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F	1	796T-126-1410	Wrench	■	1	N	○
	2	790-101-5201	Push tool KIT	■	1		
		790-101-5251	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	3	790-101-5201	Push tool KIT	●	1		
		790-101-5311	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	4	790-101-5201	Push tool KIT	●	1		
		790-101-5341	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	5	796-465-1120	Push tool	■	1		
	6	796-765-1110	Push tool	■	1		

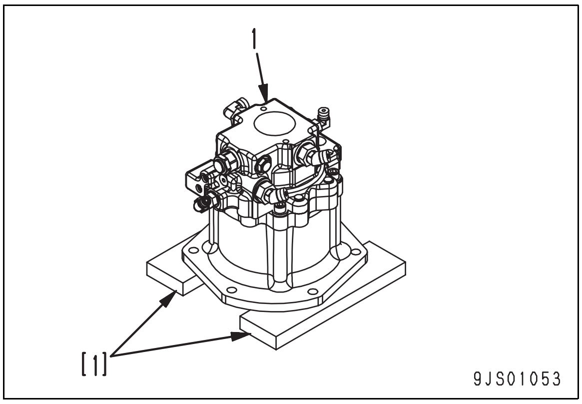
★ The figures in this section show PC27, 30, 35MR-2. Although PC40, 50MR-2 has dimensions and shapes a little different from these figures, the disassembly and assembly procedures are the same.

DISASSEMBLY

★ Since an oil drain plug is not installed, prepare an oil pan, etc. to receive oil flowing out of the case during the disassembly work.

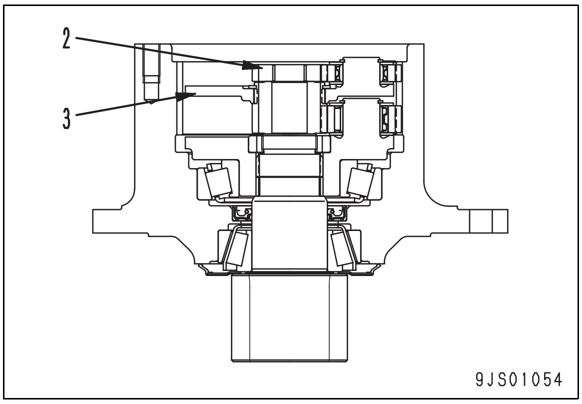
Swing machinery case
PC27, 30, 35MR-2: **Approx. 0.9 ℓ**
PC40, 50MR-2: **Approx. 1.3 ℓ**

1. **Swing motor assembly**
   Set the swing motor and swing machinery assembly to block [1] and remove swing motor assembly (1).

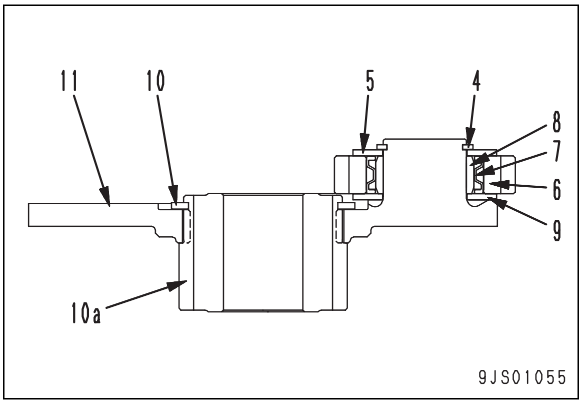


2. **No. 1 sun gear**
   Remove No. 1 sun gear (2).

3. **No. 1 planetary carrier and No. 2 sun gear assembly**
   1) Remove No. 1 planetary carrier and No. 2 sun gear assembly (3).

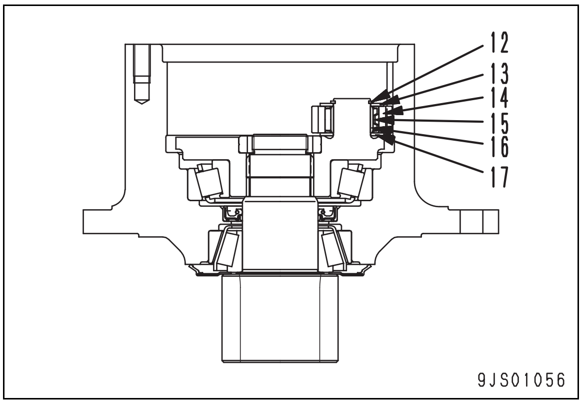


2) Remove snap ring (4), thrust washer (5), No. 1 planetary gear (6), needle roller bearing (7), spacer (8), and thrust washer (9).
3) Remove snap ring (10), and then remove No. 1 planetary carrier (11) from No. 2 sun gear (10a).

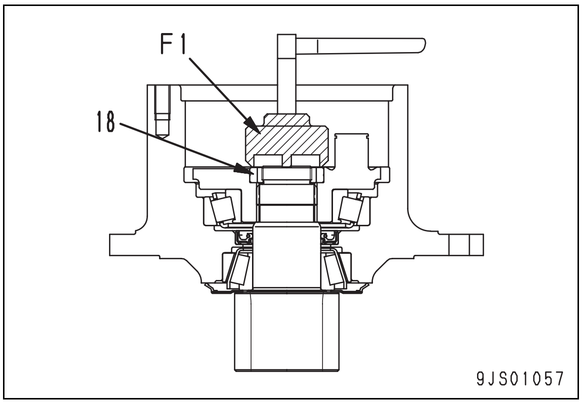


4. No. 2 planetary carrier assembly

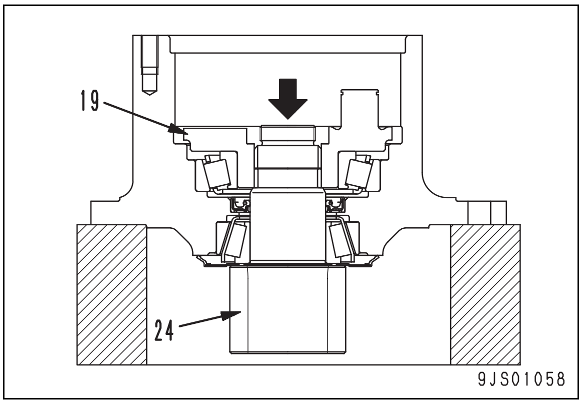
1) Remove snap ring (12), thrust washer (13), No. 2 planetary gear (14), needle roller bearing (15), spacer (16), and thrust washer (17).



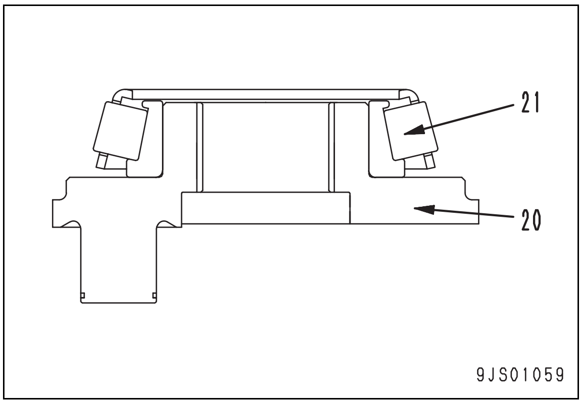
2) Using tool **F1**, remove nut (18).



3) Remove No. 2 planetary carrier and bearing assembly (19).
★ Using a press, etc., push the end of pinion shaft (24) to remove the No. 2 pinion shaft and bearing assembly.

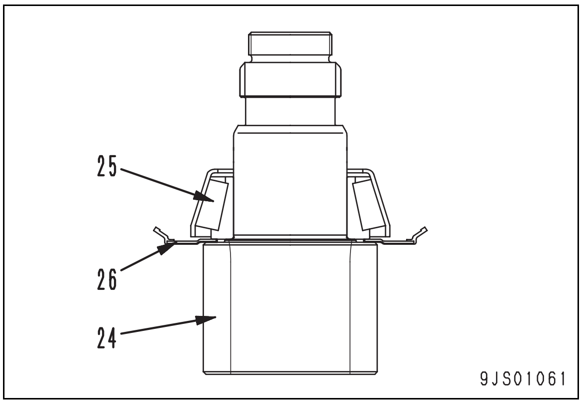


4) Remove bearing (21) from No. 2 planetary carrier (20).

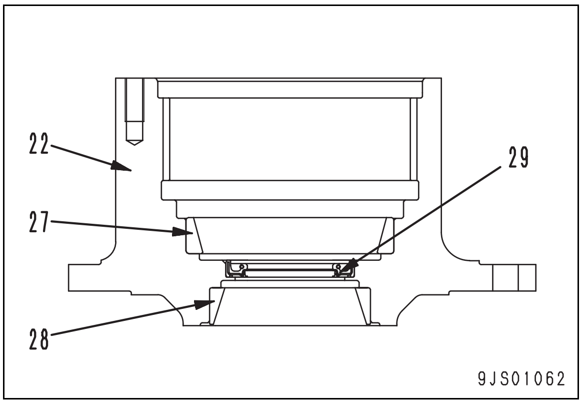


5. Pinion shaft and bearing assembly

Remove bearing (25) and seal (26) from pinion shaft (24).



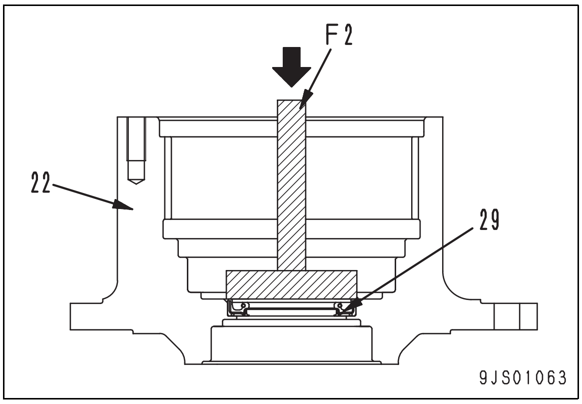
6. **Swing machinery case**
   Remove outer races (27) and (28) and oil seal (29) from swing machinery case (22).



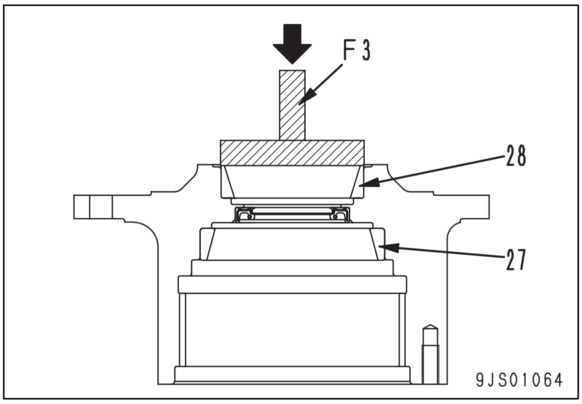
ASSEMBLY

1. **Swing machinery case**
   1) Using tool **F2**, press fit oil seal (29) to swing machinery case (22) until it is stopped.
      ★ Install the oil seal with the spring up.

      Press fitting surface of oil seal:
      Gasket sealant (LG-6)
      ★ Take care that the gasket sealant will not stick to the oil seal lip and the sliding part of the shaft.

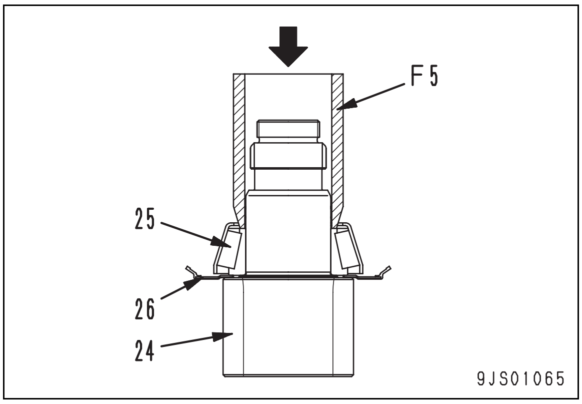


   2) Using tools **F3** and **F4**, press fit outer races (28) and (27) to the swing machinery case.
      ★ Tool **F3**: Outer race (28)
      Tool **F4**: Outer race (27)
      ★ The figure shows outer race (28).

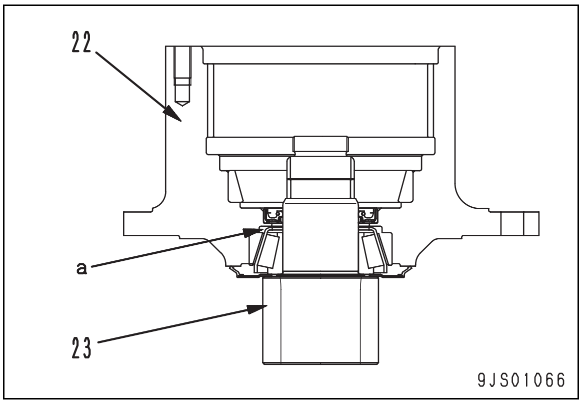


2. **Pinion shaft and bearing assembly**
   1) Install seal (26) to pinion shaft (24).

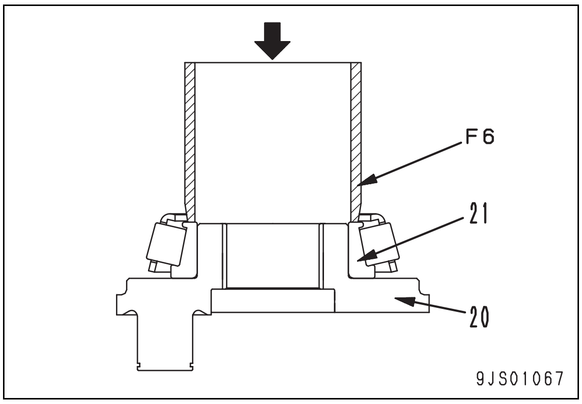
      Sliding surface of seal:
      Grease (G2-LI)
   2) Using tool **F5**, press fit bearing (25) to pinion shaft (24).
      - Press fitting force
        PC27, 30, 35MR-2:
        6.67 – 17.06 kN {0.68 – 1.74 ton}
        PC40, 50MR-2:
        7.3 – 19.7 kN {0.74 – 2.01 ton}



   3) Set swing machinery case (22) to pinion shaft and bearing assembly (23).
      ★ Fill space **a** between the swing machinery case and bearing with grease (G2-LI) to 40 – 60%.
      ★ Take care not to damage the oil seal.



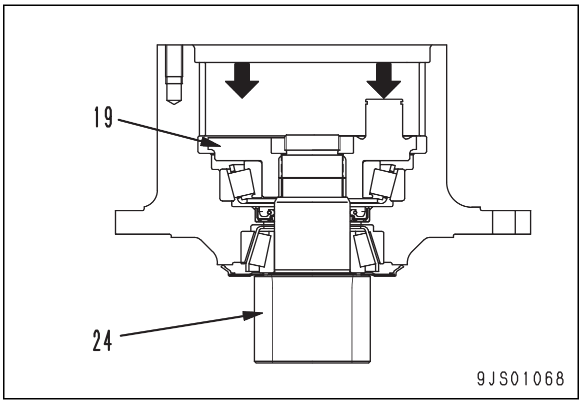
3. **No. 2 planetary carrier assembly**
   1) Using tool **F6**, press fit bearing (21) to No. 2 planetary carrier (20).
      - Press fitting force:
        2.94 – 11.18 kN {0.3 – 1.14 ton}



   2) Set No. 2 planetary carrier and bearing assembly (19) to pinion shaft (24) and press fit it with a press, etc.
      ★ Turning the case, press fit gradually.

      Spline: **Grease (G2-LI)**

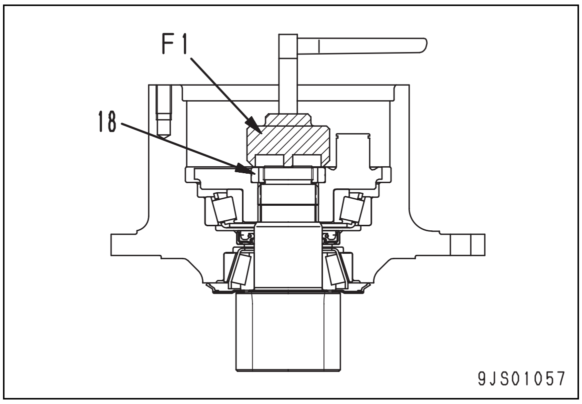
      - Press fitting force
        PC27, 30, 35MR-2:
        4.41 – 17.8 kN {0.45 – 1.82 ton}
        PC40, 50MR-2:
        4.90 – 18.8 kN {0.50 – 1.92 ton}



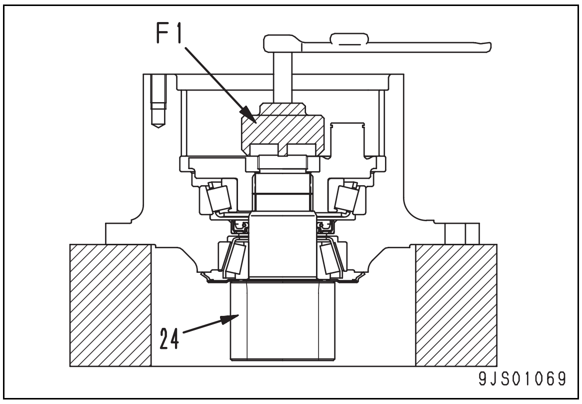
3) Using tool **F1**, tighten nut (18).

Nut: **Adhesive (LT-2)**

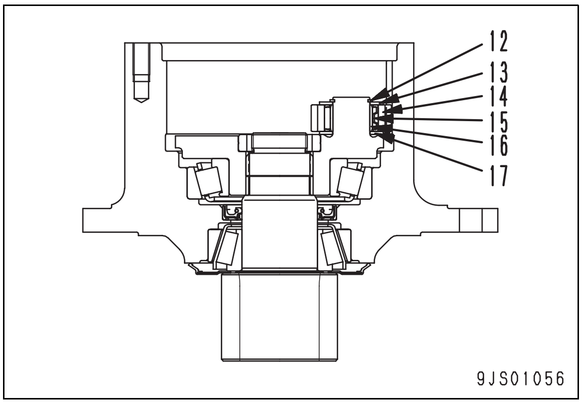
Nut
PC27, 30, 35MR-2:
245 – 294 Nm {25 – 30 kgm}
PC40, 50MR-2:
392 – 441 Nm {40 – 45 kgm}



4) Using tool **F1**, measure the starting torque of pinion shaft (24) and check that it is in the following range.
- Starting torque: Max. 13.2 Nm {1.35 kgm}

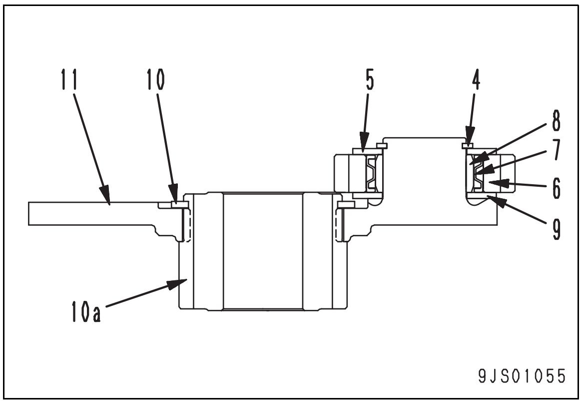


5) Install thrust washer (17), spacer (16), needle roller bearing (15), No. 2 planetary carrier (14), thrust washer (13), and snap ring (12).
★ Check that there is no play in the No. 2 planetary gear.



4. No. 1 planetary carrier and No. 2 sun gear assembly

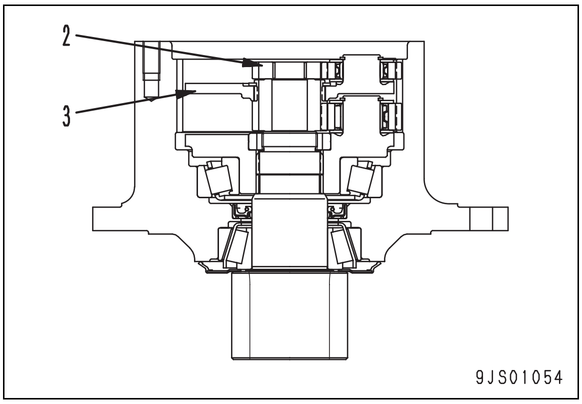
1) Install No. 1 planetary carrier (11) to No. 2 sun gear (10a), and then install snap ring (10).
2) Install thrust washer (9), spacer (8), needle roller bearing (7), No. 1 planetary gear (6), thrust washer (5), and snap ring (4).
★ Check that there is no play in the No. 1 planetary gear.



3) Install No. 1 planetary carrier and No. 2 sun gear assembly (3).

5. No. 1 sun gear

Install No. 1 sun gear (2).



6. Filling with oil

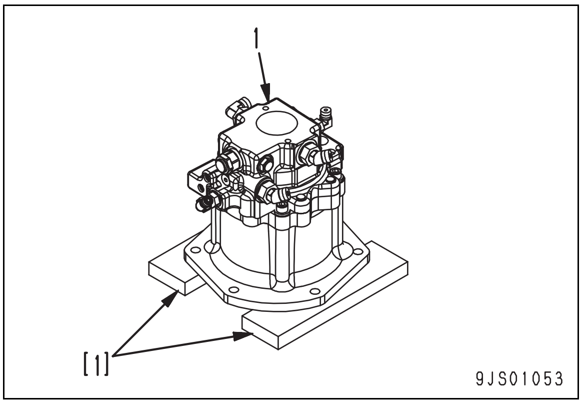
Add engine oil into the swing machinery case.

Swing machinery case
PC27, 30, 35MR-2:
Approx. 0.9 ℓ (EO10-DH)
PC40, 50MR-2:**Approx. 1.3 ℓ (EO10-DH)**

7. Swing motor assembly

Fit the O-ring and install swing motor assembly (1).

Mounting bolt
PC27, 30, 35MR-2:
59 – 74 Nm {6 – 7.5 kgm}
PC40, 50MR-2:
98 – 123 Nm {10 – 12.5 kgm}



REMOVAL AND INSTALLATION OF WORK EQUIPMENT ASSEMBLY

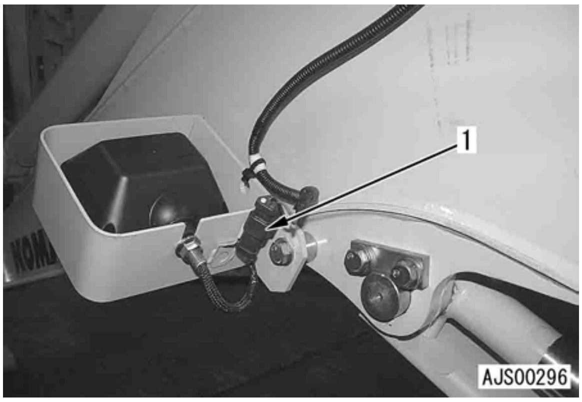
⚠ Release the residual pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing residual pressure in hydraulic circuit.

⚠ Extend the boom cylinder and bucket cylinder to the stroke end and lower the work equipment to the ground.

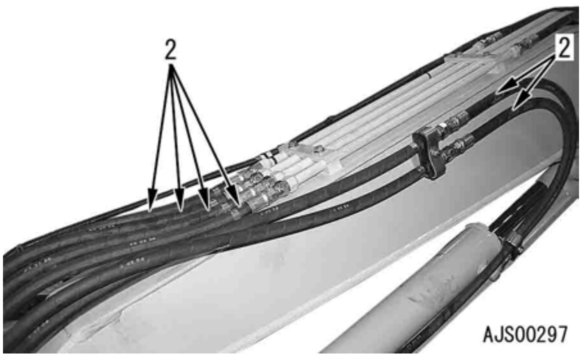
⚠ Set the work equipment lock lever in the LOCK position.

REMOVAL

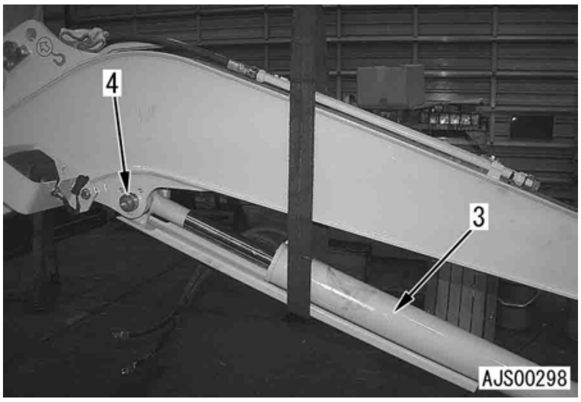
1. Disconnect connector (1) and remove the wiring harness from the boom.



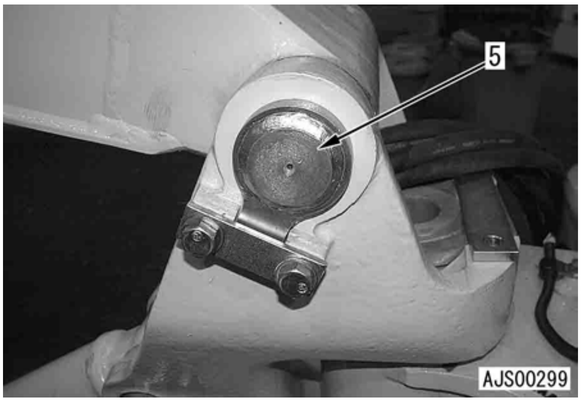
2. Disconnect 6 hoses (2).



3. Sling boom cylinder (3) temporarily and remove the plate and head-side pin (4). [*1]
   ★ Lower the boom cylinder onto a block, etc.

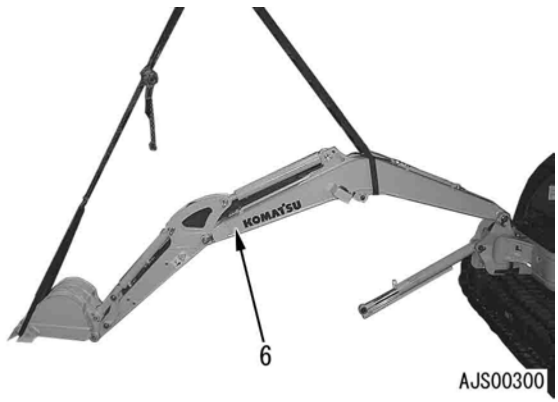


4. Sling the work equipment assembly temporarily.
5. Remove boom foot pin (5). [*2]



6. Lift off work equipment assembly (6).

   Work equipment assembly
   PC27MR-2: **280 kg**
   PC30MR-2: **310 kg**
   PC35MR-2: **350 kg**
   PC40MR-2: **480 kg**
   PC50MR-2: **550 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

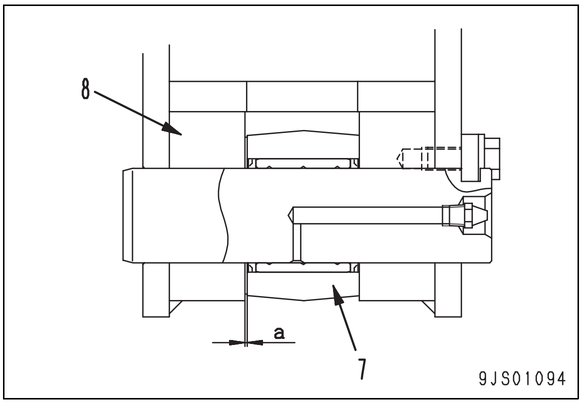
When aligning the pin holes, never insert your fingers in them.

Sliding surfaces of pin and boom:
Molybdenum disulfide grease (LM-P)

Greasing after installation:
Grease (Hyper white grease)

★ Adjust the shim so that clearance **a** between boom cylinder head (7) and boom (8) will be less than 1 mm. (PC40, 50MR-2)

- Set shim thickness: 1 mm



[*2]

When aligning the pin holes, never insert your fingers in them.

Sliding surfaces of pin and swing bracket:
Molybdenum disulfide grease (LM-P)

Greasing after installation:
Grease (Hyper white grease)

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

REMOVAL AND INSTALLATION OF REVOLVING FRAME ASSEMBLY

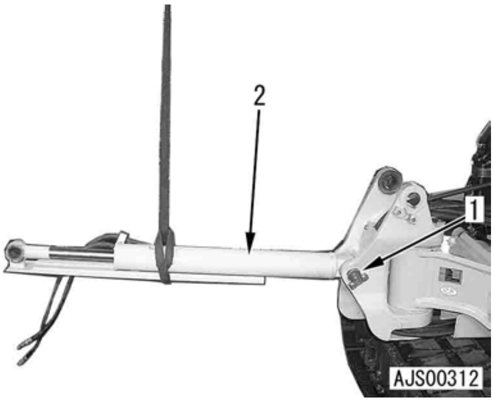
REMOVAL

1. Remove the work equipment. For details, see REMOVAL AND INSTALLATION OF WORK EQUIPMENT ASSEMBLY.

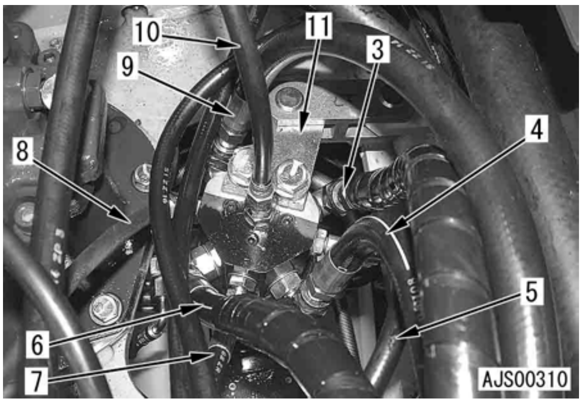
2. Remove the canopy and floor frame (operator's cab and floor frame) assembly. For details, see REMOVAL AND INSTALLATION OF FLOOR FRAME ASSEMBLY.

3. Pull out pin (1) and remove boom cylinder assembly (2). [*1]

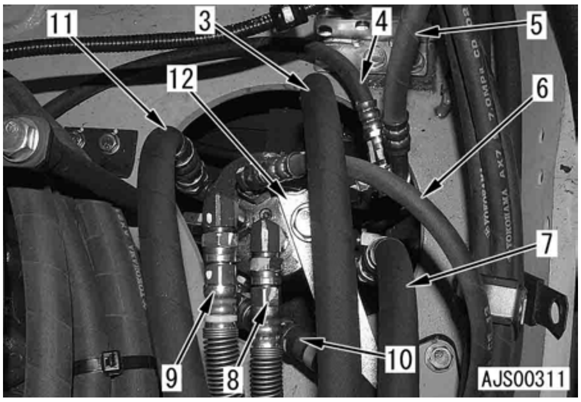
   Boom cylinder
   PC27, 30, 35MR-2: **30 kg**
   PC40, 50MR-2: **45 kg**



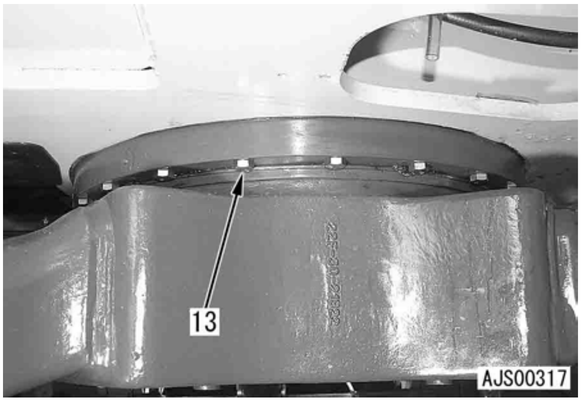
4. Disconnect the hoses from the center swivel joint and remove the lever. [*2]
   - PC27, 30, 35MR-2:
     Hoses (3) – (10) and lever (11)



   - PC40, 50MR-2:
     Hoses (3) – (11) and lever (12)

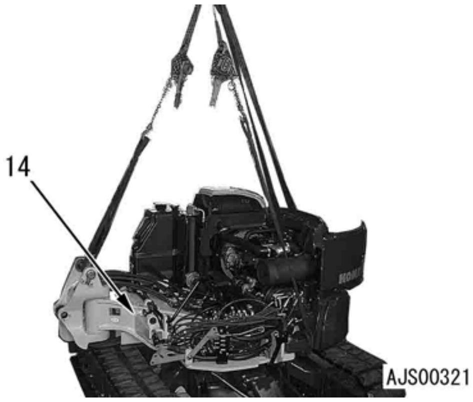


5. Sling the revolving frame assembly temporarily and remove mounting bolts (13). [*3]
   ★ Leave 2 bolts each on the front and rear sides.



6. Remove the remaining mounting bolts and lift off revolving frame assembly (14).
   ★ Balancing the revolving frame assembly with lever blocks, etc., remove the remaining mounting bolts.
   ★ When removing the revolving frame assembly, check that all the pipes have been disconnected and take care not to damage the center swivel joint.

   Revolving frame assembly
   PC27MR-2: **1,200 kg**
   PC30MR-2: **1,300 kg**
   PC35MR-2: **1,550 kg**
   PC40MR-2: **1,850 kg**
   PC50MR-2: **2,000 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

When aligning the pin holes, never insert your fingers in them.

Sliding surfaces of pin and swing bracket:
Molybdenum disulfide grease (LM-P)

Greasing after installation:
Grease (Hyper white grease)

[*2]

Lever mounting bolt: **Adhesive (LT-2)**

Lever mounting bolt:
153 – 190 Nm {15.5 – 19.5 kgm}

[*3]

Revolving frame assembly mounting bolt:
Adhesive (LT-2)

Revolving frame assembly mounting bolt
PC27, 30, 35MR-2:
117.6 – 137.2 Nm {12 – 14 kgm}
PC40, 50MR-2:
98 – 123 Nm {10 – 12.5 kgm}

- **Refilling with oil (Hydraulic tank)**

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

★ Bleed air. For details, see TESTING AND ADJUSTING, Bleeding air from each part.

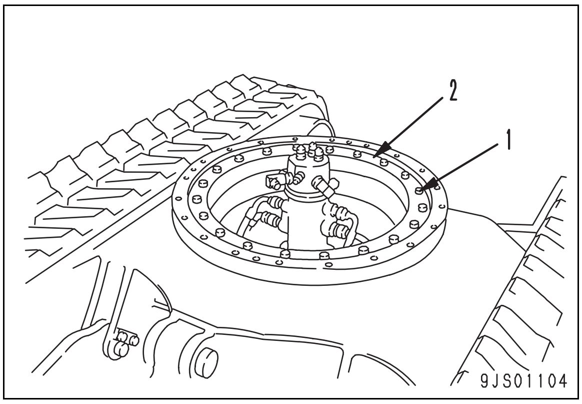
REMOVAL AND INSTALLATION OF SWING CIRCLE ASSEMBLY

REMOVAL

1. Remove the revolving frame assembly. For details, see REMOVAL AND INSTALLATION OF REVOLVING FRAME ASSEMBLY.

2. Remove mounting bolts (1). [*1]
   ★ PC27, 30, 35MR-2: 20 pieces
   PC40, 50MR-2: 24 pieces

3. Install the hanging bolts and lift off swing circle assembly (2). [*2]
   PC27, 30, 35MR-2: **40 kg**
   PC40, 50MR-2: **65 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt: **Adhesive (LT-2)**

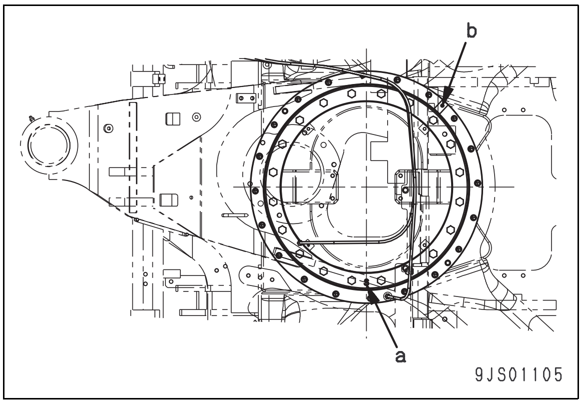
Mounting bolt
PC27, 30, 35MR-2:
117.6 – 137.2 Nm {12 – 14 kgm}
(Target: 127.4 Nm {13 kgm})
PC40, 50MR-2:
98 – 122.5 Nm {10 – 12.5 kgm}
(Target: 112.7 Nm {11.5 kgm})

[*2]

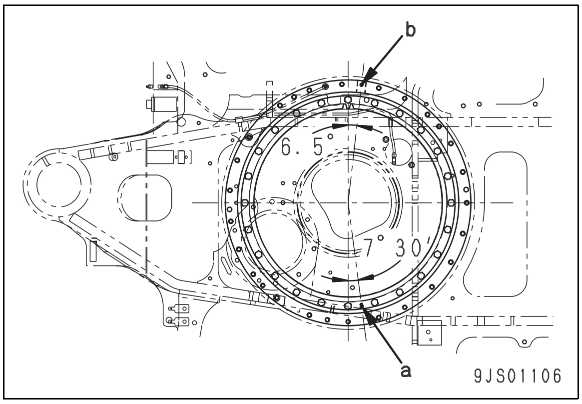
★ When installing the swing circle assembly, set inner race soft zone **a** (mark of S) and outer race soft zone **b** as shown below.

Inner race tooth surface: **Grease (G2-LI)**

PC27, 30, 35MR-2



PC40, 50MR-2



DISASSEMBLY AND ASSEMBLY OF CONTROL VALVE ASSEMBLY

In this section, only the precautions for assembling the control valve assembly are explained.

★ Work in a clean indoor place where there is no dirt and dust.

★ Clean the parts in clear solvent, and then dry them with compressed air.

★ Replace a part having burrs with new one.

★ Coat the sliding surfaces of each part with engine oil before installing.

★ Take care of the installed direction of each spool.

★ When tightening the plug of each spool, apply a drop (about 0.02 g) of LOCTITE (No. 638) to it.

★ Apply Sealend 242 or equivalent to the mating faces.

★ For tightening torque of each part, see STRUCTURE, FUNCTION AND MAINTENANCE STANDARD, Control valve.

DISASSEMBLY AND ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
U	1	790-502-1003	Cylinder repair stand	■	1		
		790-101-1102	Hydraulic pump	■	1		
	2	790-330-1100	Wrench assembly	■	1		
	3	Commercially available	Socket (Width across flats: 41 mm)	■	1		
		Commercially available	Socket (Width across flats: 46 mm)	■	1		
		790-302-1390	Socket (Width across flats: 46 mm, long type)	■	1		
		790-302-1270	Socket (Width across flats: 50 mm)	■	1		
		790-302-1490	Socket (Width across flats: 50 mm, long type)	■	1		
		790-302-1280	Socket (Width across flats: 55 mm)	■	1		
		790-302-1470	Socket (Width across flats: 55 mm, long type)	■	1		
	4	790-201-1702	Push tool KIT	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1731	• Push tool		1		
		790-201-1751	• Push tool		1		
		790-201-1741	• Push tool		1		
		790-201-1761	• Push tool		1		
	5	790-201-1500	Push tool KIT	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1540	• Plate		1		
		790-201-1560	• Plate		1		
		790-201-1550	• Plate		1		
		790-201-1570	• Plate		1		
	6	790-720-1000	Expander	●	1		
	7	796-720-1630	Ring	●	1		
		07281-00709	Clamp	●	1		
		796-720-1640	Ring	●	1		
		07281-00909	Clamp	●	1		
		796-720-1740	Ring	●	1		
		07281-00809	Clamp	●	1		
		796-720-1650	Ring	●	1		
		07281-01029	Clamp	●	1		
		796-720-1660	Ring	●	1		
		07281-00159	Clamp	●	1		

★ In this section, only the assembly procedure is explained.

ASSEMBLY

★ The contents of this section are common to all the cylinders, unless otherwise specified.

★ Take care not to damage the packings, dust seals, O-rings, etc.

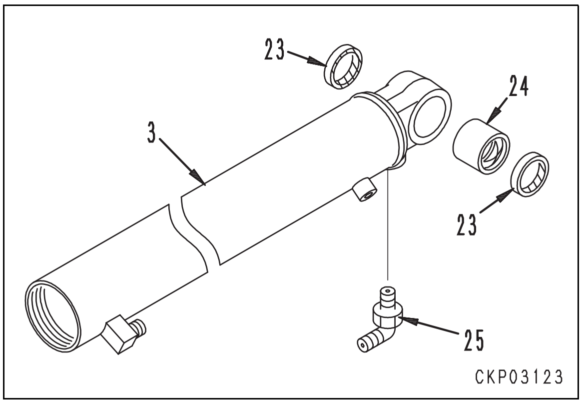
★ Clean each part thoroughly. After assembling, close the piping ports and pin inserting holes so that dirt will not enter them.

★ Do not insert each backup ring forcibly, but warm it in water at 50 – 60°C and then insert it.

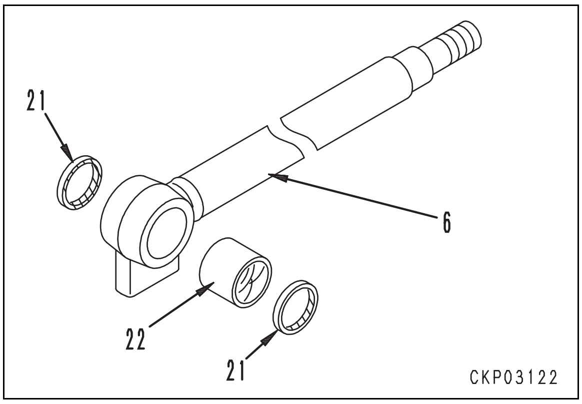
1. Cylinder

1) Fit the O-ring and install elbow (25) to cylinder (3).
   ★ Perform this step for only the arm cylinder of PC35, 40, 50MR-2.

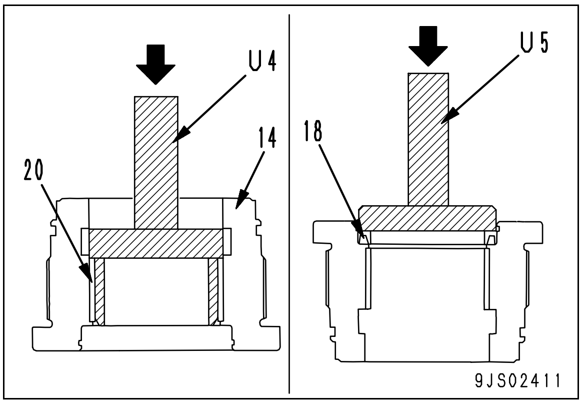
   Elbow
   PC35MR-2:
   84 – 132 Nm {8.5 – 13.5 kgm}
   PC40, 50MR-2:
   128 – 186 Nm {13 – 19 kgm}
2) Press fit bushing (24).
3) Press fit 2 dust seals (23).



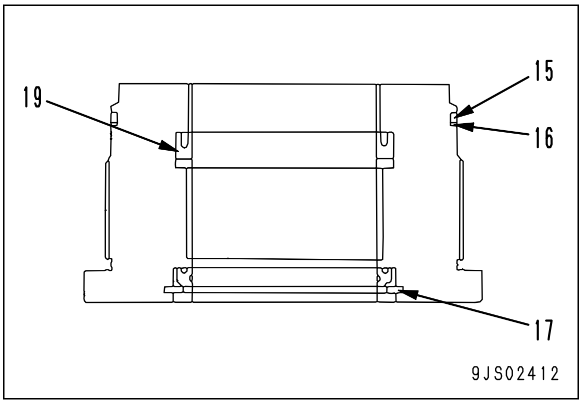
2. **Piston rod**
   1) Press fit bushing (22) to piston rod (6).
   2) Press fit 2 dust seals (21).



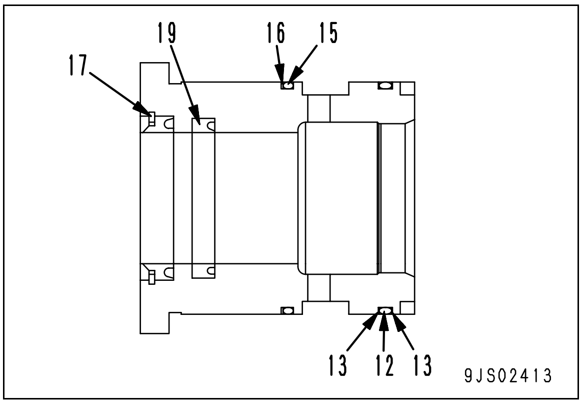
3. **Cylinder head assembly**
   1) Using tool **U4**, press fit bushing (20) to cylinder head (14).
      ★ Except boom cylinder
   2) Using tool **U5**, press fit dust seal (18).



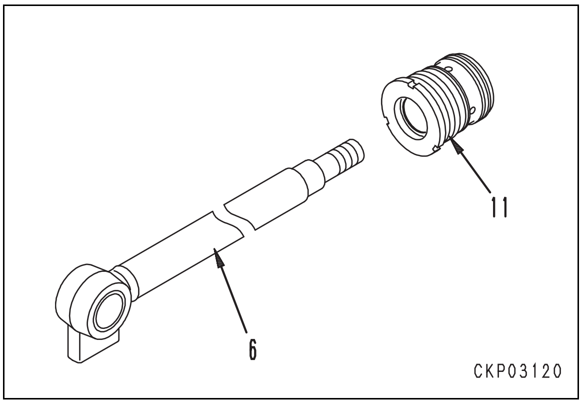
   3) Using snap ring pliers, install snap ring (17).
   4) Install rod packing (19).
   5) Install O-ring (15) and backup ring (16).



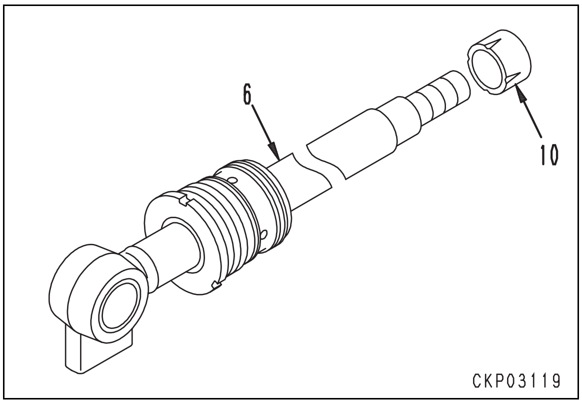
   6) Install O-ring (12) and 2 backup rings (13).
      ★ Boom cylinder only



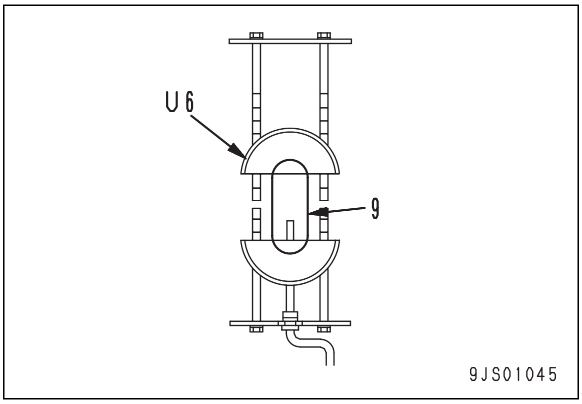
   7) Fit O-ring and install cylinder head assembly (11) to piston rod (6).



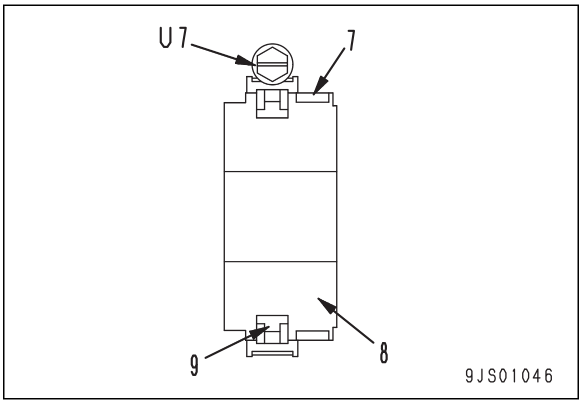
4. **Piston assembly**
   1) Install cushion plunger (10) to piston rod (6).
      ★ Boom cylinder only



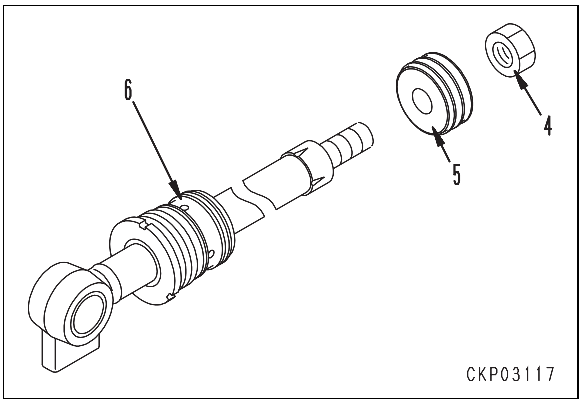
2) Set the piston ring (9) on tool **U6** and turn the handle 8 to 10 times to expand the ring.



3) Install piston ring (9) to piston (8).
4) Using tool **U7**, compress piston ring (9).
5) Install wear ring (7).



6) Install piston assembly (5) to piston rod (6).



7) Set piston rod assembly (2) to tool **U1**.
8) Using tool **U3**, install piston nut (4).
★ Width across flats of piston nut :

(Unit: mm)

Model	Boom	Arm	Bucket	Swing	Blade
PC27MR	46	46	36	41	50
PC30MR	46	46(*)	46	41	50
PC35MR	46	50(*)	46	55	50
PC40MR	50	55(*)	50(*)	55	55
PC50MR	50	55(*)	50(*)	55	55

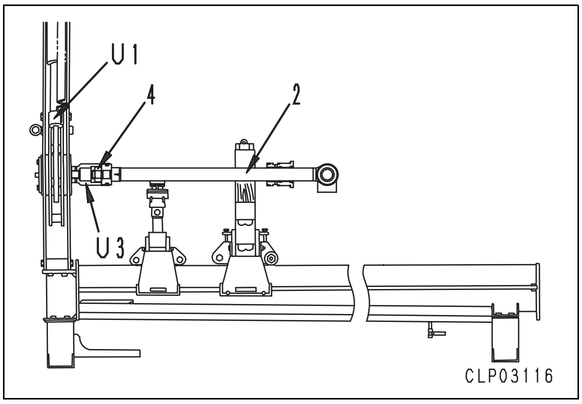
★ Use long-type sockets for the nuts marked with *.

Piston nut : **Thread tightener (Loctite 262 or equivalent)**

Piston nut :

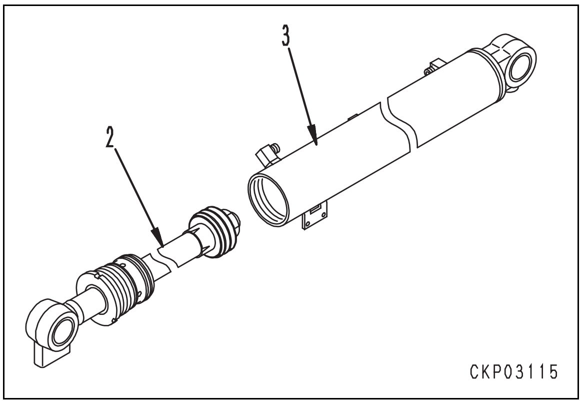
(Unit: Nm {kgm})

Model	Boom	Arm	Bucket	Swing	Blade
PC27 MR	785±78.5 {80±8.0}	912±91.0 {93±9.3}	412±41.0 {42±4.2}	647±64.5 {66±6.6}	1.08±0.11 {110±11.0}
PC30 MR	912±91.0 {93±9.3}	912±91.0 {93±9.3}	785±78.5 {80±8.0}	647±64.5 {66±6.6}	1.08±0.11 {110±11.0}
PC35 MR	912±91.0 {93±9.3}	1.25±0.13 {127±12.7}	785±78.5 {80±8.0}	1.42±0.14 {145±14.5}	1.08±0.11 {110±11.0}
PC40 MR	1.25±0.13 {127±12.7}	1.67±0.17 {170±17.0}	1.08±0.11 {110±11.0}	1.42±0.14 {145±14.5}	1.42±0.14 {145±14.5}
PC50 MR	1.25±0.13 {127±12.7}	1.67±0.17 {170±17.0}	1.08±0.11 {110±11.0}	1.42±0.14 {145±14.5}	1.42±0.14 {145±14.5}



5. Piston rod assembly

1) Install piston rod assembly (2) to cylinder (3).

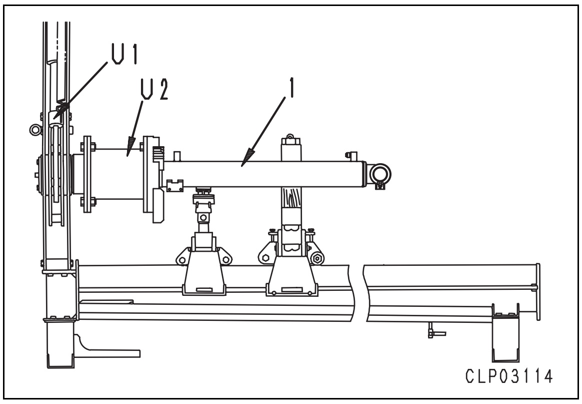


2) Set cylinder assembly (1) to tool **U1**.
3) Using tool **U2**, tighten cylinder head.

Cylinder head :

(Unit: Nm{kgm})

Model	Boom	Arm	Bucket	Swing	Blade
PC27 MR	569±57 {58±5.8}	833±83 {85±8.5}	659±57.0 {58±5.8}	676.9±67.7 {69±6.9}	637±63.5 {65±6.5}
PC30 MR	588±59 {60±6.0}	676.9±67.7 {69±6.9}	677±67.5 {69±6.9}	588±59 {60±6.0}	637±63.5 {65±6.5}
PC35 MR	588±59 {60±6.0}	785±78.5 {80±8.0}	677±67.5 {69±6.9}	735±73.5 {75±7.5}	735±73.5 {75±7.5}
PC40 MR	736±73.6 {75±7.5}	785±78.5 {80±8.0}	785±78.5 {80±8.0}	676.2±67.6 {69±6.9}	931±93.1 {95±9.5}
PC50 MR	736±73.6 {75±7.5}	961±96.1 {98±9.8}	863±86.5 {88±8.8}	735±73.5 {75±7.5}	931±93.1 {95±9.5}



6. Piping

Install cylinder piping.

Sleeve nut:
PC27, 30, 35MR-2 (Bucket cylinder):
46.1 – 61.8 Nm {4.7 – 6.3 kgm}
PC40, 50MR-2 (Boom cylinder):
84 – 123 Nm {8.5 – 12.5 kgm}
PC40, 50MR-2 (Arm cylinder):
128 – 172 Nm {13 – 17.5 kgm}
PC40, 50MR-2 (Bucket cylinder):
84 – 123 Nm {8.5 – 12.5 kgm}

REMOVAL AND INSTALLATION OF AIR CONDITIONER UNIT ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X	1	799-703-1200	Service tool KIT	■	1		
		799-703-1100	Vacuum pump (100 V)	■	1		
		799-703-1110	Vacuum pump (220 V)	■	1		
		799-703-1120	Vacuum pump (240 V)	■	1		
		799-703-1401	Gas leak detector	■	1		

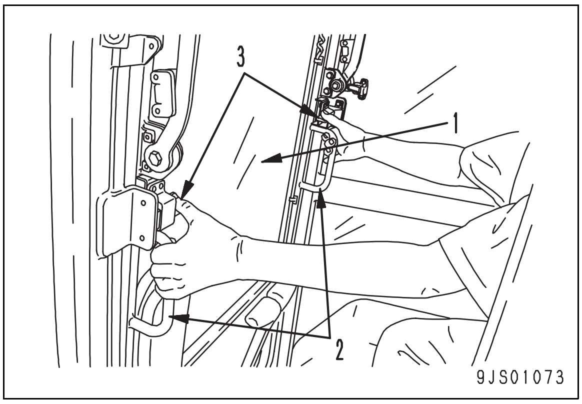
REMOVAL

⚠ Stop the machine on a level place, lower the work equipment to the ground, and set the work equipment lock lever in the LOCK position.

⚠ Disconnect the cable from the negative (–) terminal of the battery.

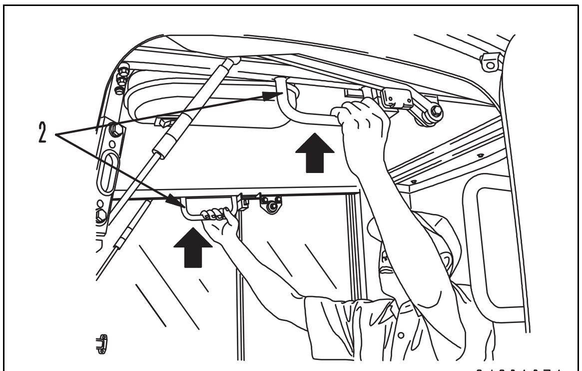
1. Collect the refrigerant (gas) from the air conditioner circuit. [*1]

2. Retract front window (upper side) (1) in the ceiling.
   1) Hold right and left grips (2) in the operator's cab and pull them toward you, keeping lock levers (3) down.



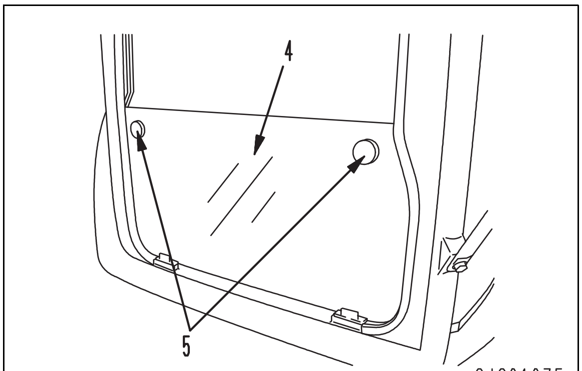
9JS01073

   2) Pull up the front window. When it stops moving backward, push up grips (2) until they are locked securely.



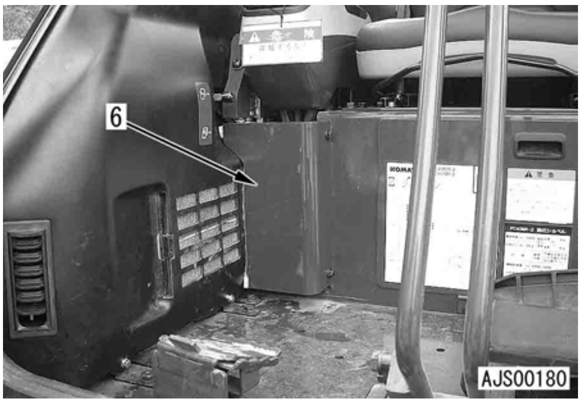
9JS01074

3. Remove front window (lower side) (4).
   ★ Hold knobs (5) and pull up and remove the window, and then store it at the rear of the operator's seat in the operator's cab.



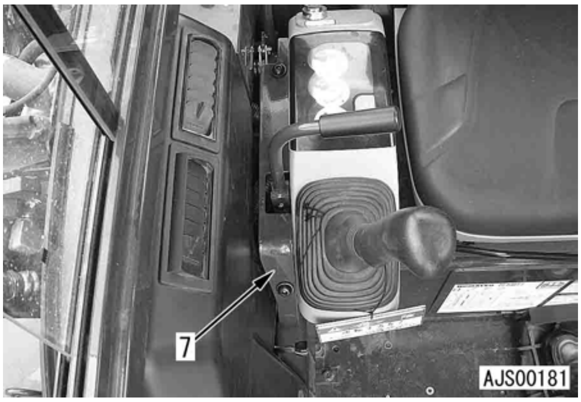
9JS01075

4. Remove the floor mat and right PPC hose cover (6).



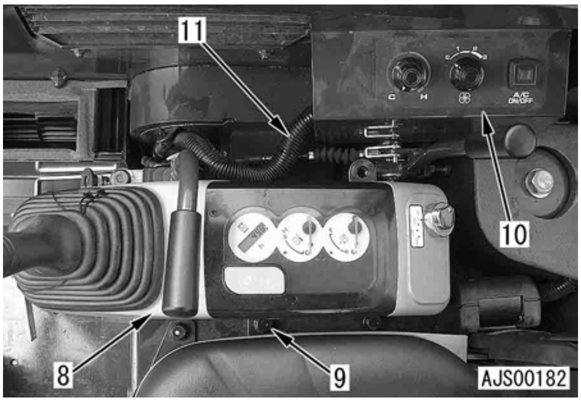
AJS00180

5. Remove cover (7).

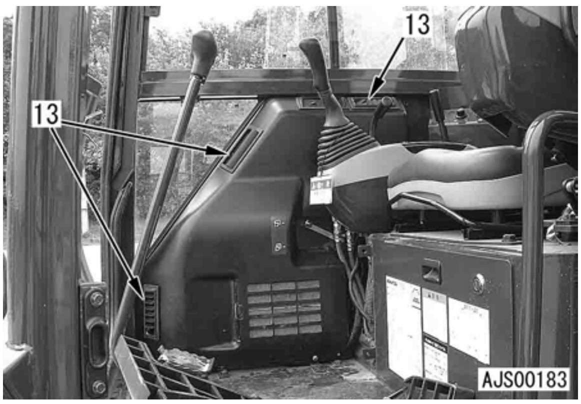


6. Remove 3 mounting bolts (9) of right lever stand (8) so that the stand will move.

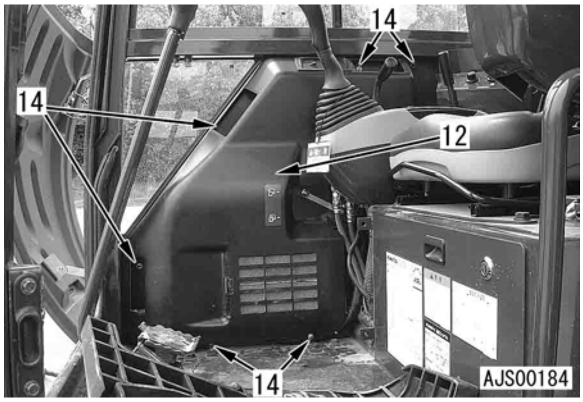
7. Remove air conditioner control panel (10) and clamp of wiring harness (11).



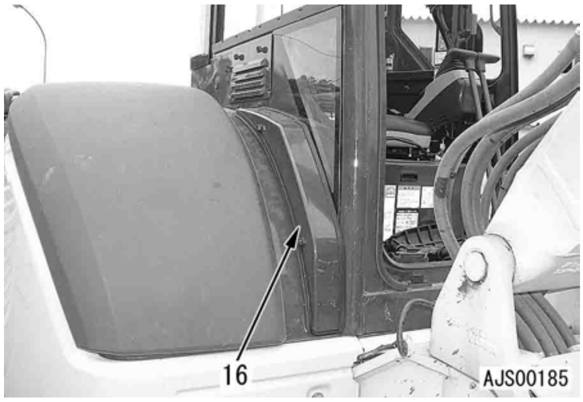
8. Remove cover (12).
   1) Move the right lever stand backward.
   2) Remove 3 air outlets (13).



   3) Remove 6 mounting bolts (14) and cover (12).

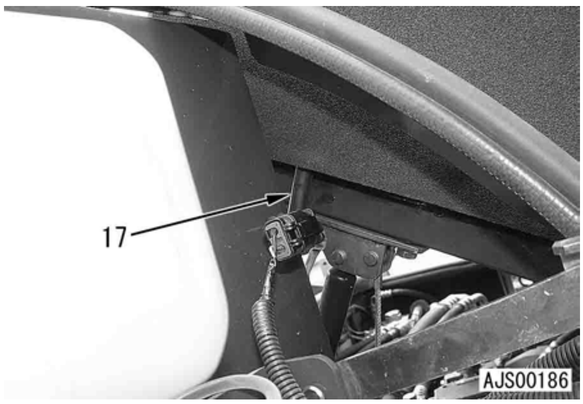


9. Remove cover (16).



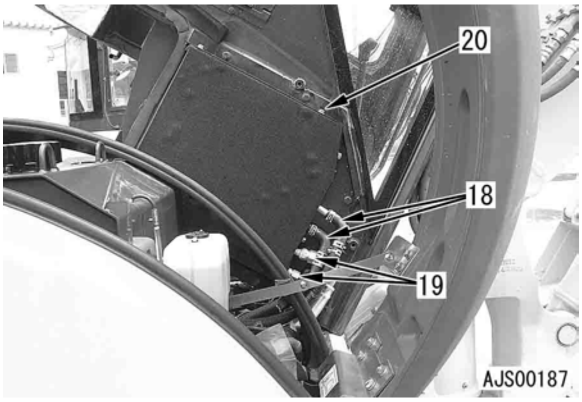
10. Tilt up the floor frame.
    For details, see How to open and close (tilt) floor.

11. Disconnect drain hose (17).



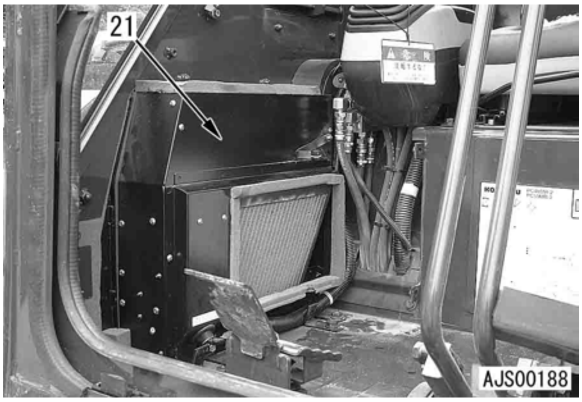
12. Disconnect 2 water hoses (18) and 2 air conditioner tube (19). [*2]
    ★ Plug the hoses to prevent dirt from entering them.

13. Remove 4 air conditioner unit assembly mounting bolts (20).



14. Tilt down the floor frame.

15. Pull air conditioner unit assembly (21) toward you and remove it and control panel together.
    ★ After pulling out the air conditioner unit assembly halfway, disconnect connector F11.



INSTALLATION

- Carry out installation in the reverse order to removal.

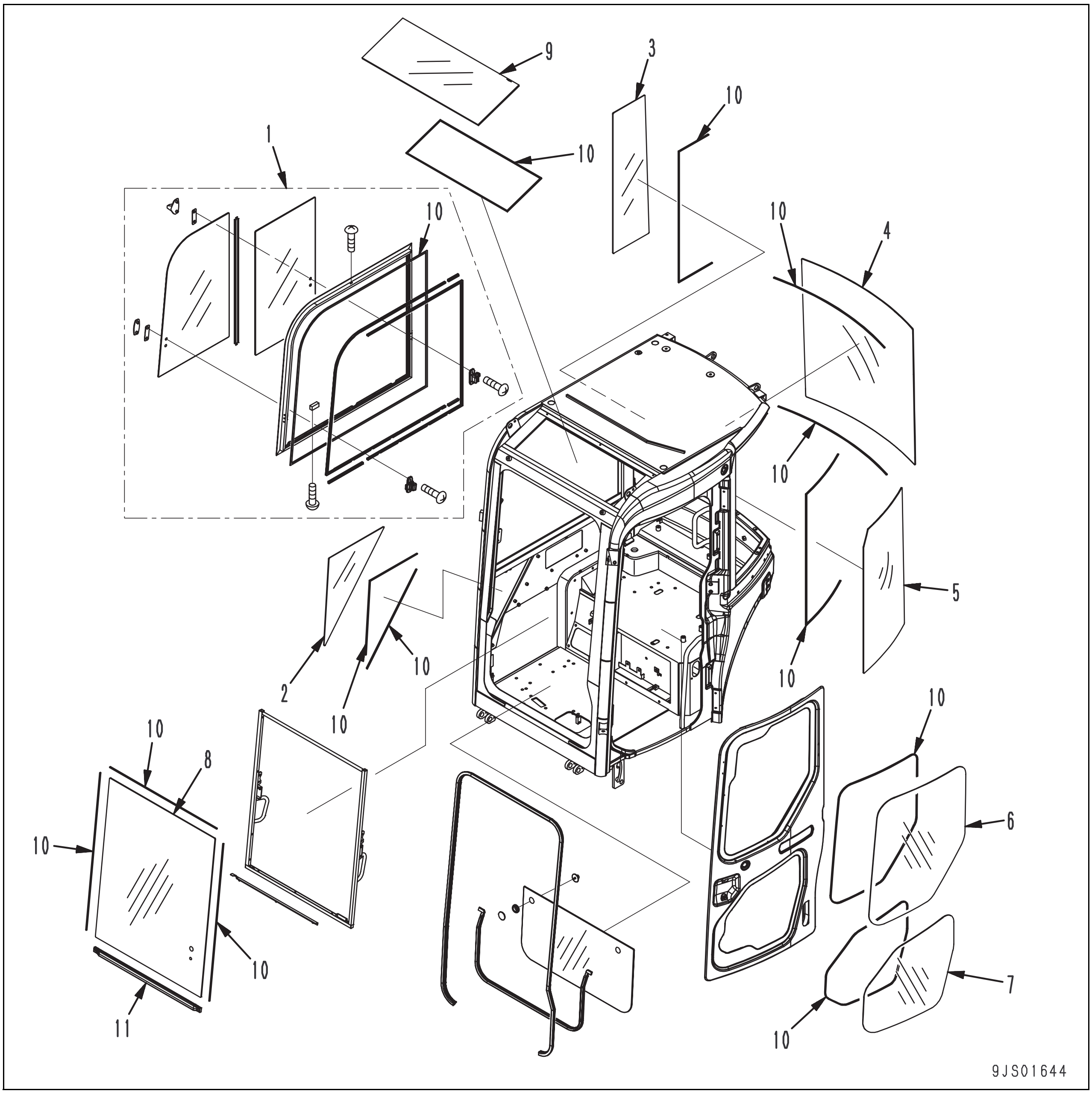
★ When installing, check that the O-ring is fitted to each joint of the air conditioner hoses.
★ Check that each O-ring is free from damage and deterioration.

[*1]
★ Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

[*2]
★ Apply compressor oil (ND-OIL8) to the threaded part of each refrigerant pipe and tighten the pipe with double spanner.

M16 x 1.5 thread of tube:
11.8 – 14.7 Nm {1.2 – 1.5 kgm}
M24 x 1.5 thread of tube:
29.4 – 34.3 Nm {3.0 – 3.5 kgm}

REMOVAL AND INSTALLATION OF OPERATOR’S CAB GLASS (STUCK GLASS)



★ On the 5 faces of the operator's cab, including the ceiling, panes (1) - (9) are stuck. (Ceiling (9) is a clear plate.)
★ When replacing front window glass (8), remove front window assembly. (It is impossible to replace only the front window glass while the front window assembly is installed to the operato’s cab.)
★ For the procedure for replacing the front window assembly, see REMOVAL AND INSTALLATION OF FRONT WINDOW ASSEMBLY.

(1) Right sash window glass assembly
(2) Right front lower triangular window glass
(3) Right rear window glass
(4) Rear window glass
(5) Left rear window glass
(6) Door upper window glass
(7) Door lower window glass
(8) Front window glass
(9) Clear plate
(10) Both-sided adhesive tape
(11) Center trim seal

★ **Precautions for removing and installing glass**
- When removing and installing the glass, be sure to put on protective goggles.
- When using primer or degreasing solvent, take care of fire and ventilation extremely.
- If a shock is given to an edge of the glass, the glass is broken easily. Handle the glass with care.
- If primer, caulking material, or adhesive gets in your eye, wash you eye with much water, and then consult an eye doctor.

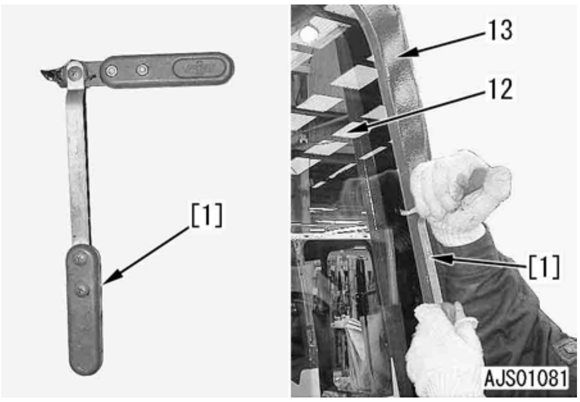
SPECIAL TOOLS

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X	2	793-498-1210	Lifter (Suction cup)	■	2		

REMOVAL

★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (12) and operator's cab (metal sheet) (13).

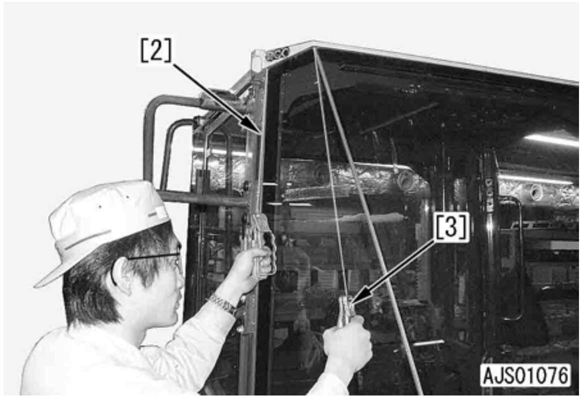


★ When seal cutter is not available

1) Make holes on the adhesive and both-sided adhesive tape with a drill and pass a fine wire (piano wire, etc.) [2] through the holes.

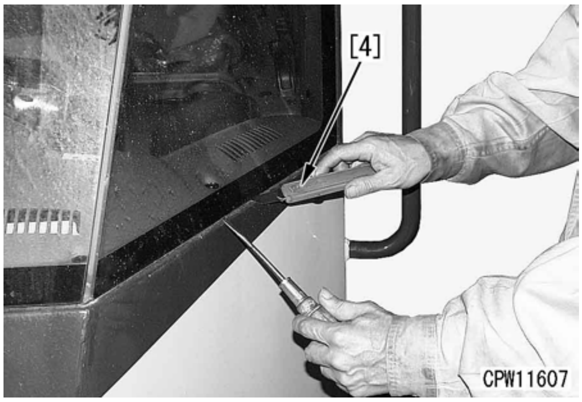
2) Grip both ends of the wire with pliers [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and both-sided adhesive tape.
   ★ Since the wire may be broken by the frictional heat, apply lubricant to it.

(The figure shows the operator's cab of a wheel loader.)



★ If the window glass is broken finely, it may be removed with knife [4] and a screwdriver.
★ Widening the cut with a screwdriver, cut the adhesive and both-sided adhesive tape with knife [4].

(The figure shows the operator's cab of a wheel loader.)

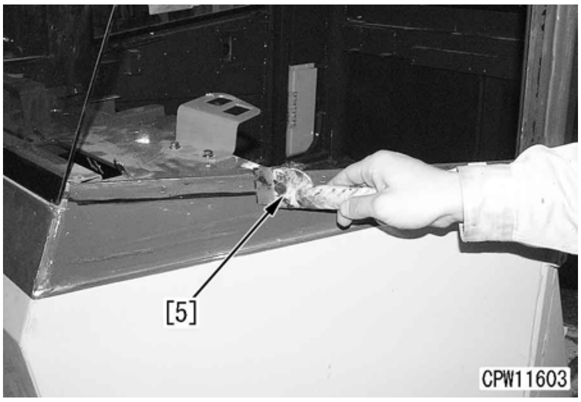


2. Remove the window glass.

INSTALLATION

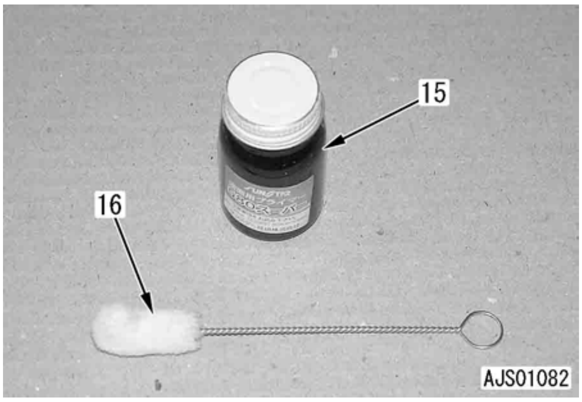
1. Using a knife and scraper [5], remove the remaining adhesive and both-sided adhesive tape from the metal sheets (glass sticking surfaces) of the operator's cab.
   ★ Remove the adhesive and both-sided adhesive tape to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces. (If the painted surfaces are scratched, adhesion will be lowered.)

   (The figure shows the operator's cab of a wheel loader.)



2. Remove oil, dust, dirt, etc. from the sticking surfaces of operator’s cab (13) and window glass (14) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean the all black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.

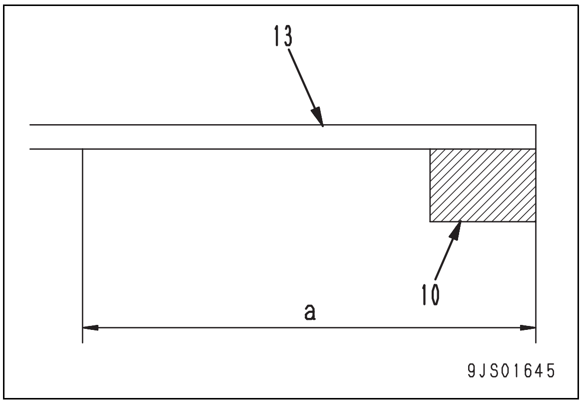
3. Apply primer (15).
   ★ Since the primer has a large effect on the adhesion of the glass, never apply a wrong primer. If you have applied a wrong primer by mistake, wipe it off with cleaning solvent.
   ★ The using limit of primer is 4 months after the date of manufacture. Do not use primer after this limit.
   ★ Use the primer within 2 hours after unpacking it.
   ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is packed.)
   1) Stir the primers for paint and glass sufficiently before using them.
      ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
   2) When reusing primer brush (16), wash it in white gasoline.
      ★ After washing the brush, check it again for dirt and foreign matter.
      ★ Prepare respective brushes for the paint primer glass primer.



   3) Evenly apply paint primer to the surfaces to stick both-sided adhesive tapes (10) and the surfaces out of those surfaces on operator's cab (13) which will be coated with the adhesive.

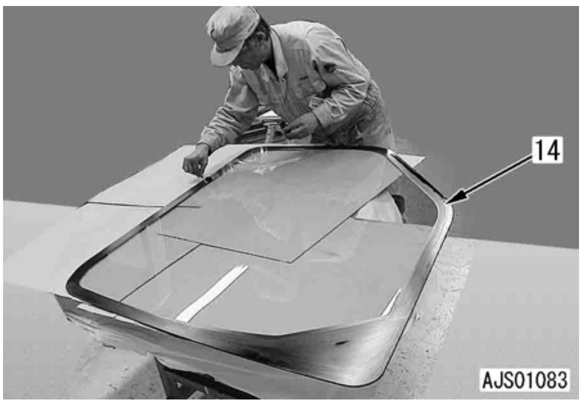
      Paint primer:
      SUNSTAR PAINT PRIMER 435-95
      ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)

★ Parts to be coated with primer: Apply the primer all over dimension (**a**).
• Dimension to apply primer (**a**): **25 mm**

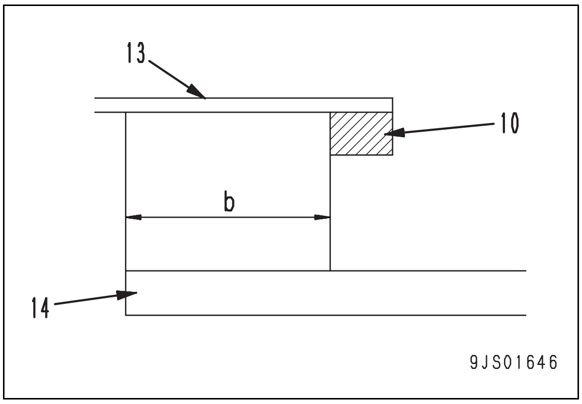


★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.

4) Evenly apply glass primer to the sticking surfaces of window glass (14).
Glass primer:
SUNSTAR GLASS PRIMER 435-41
★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)



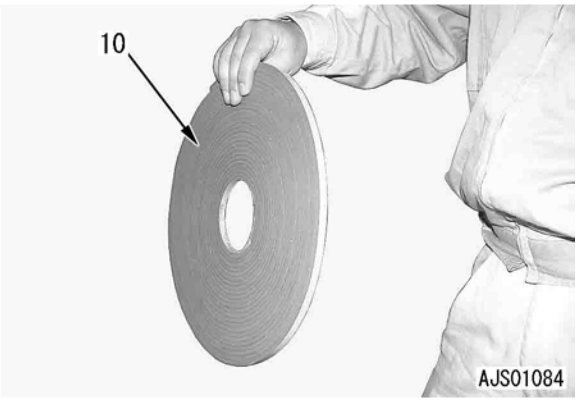
★ Parts to be coated with primer: Apply the primer to the sticking surfaces of window glass (14) and all over dimension (**b**) which will be on both-sided adhesive tape (10) and operator's cab (13).
★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.



4. Stick both-sided adhesive tape (10) along the inside edge of the glass sticking section.
★ The both-sided adhesive tape is used to stop the adhesive from flowing out, finish the appearance neatly, apply the adhesive evenly and stabilize its strength, and protect the glass until the adhesive is set.
★ The both-sided adhesive tape is classified into 2 types by the sectional dimensions. Use those types according to the following table.

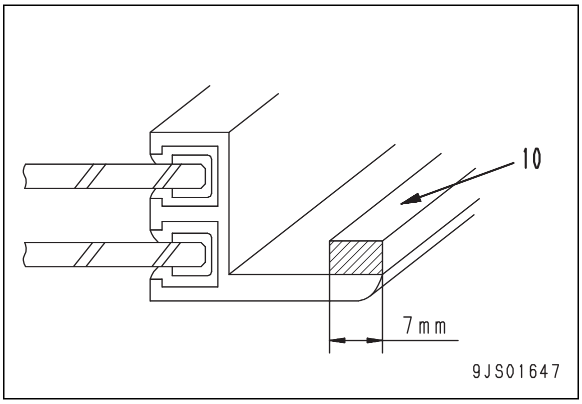
Both-sided adhesive tape	Sectional size of both-sided adhesive tape
For general use	5 mm thick × 7 mm wide
For front sash	5 mm thick × 5 mm wide

★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.
★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
★ Take that the both-sided adhesive tape will not float at each corner of the window frame.

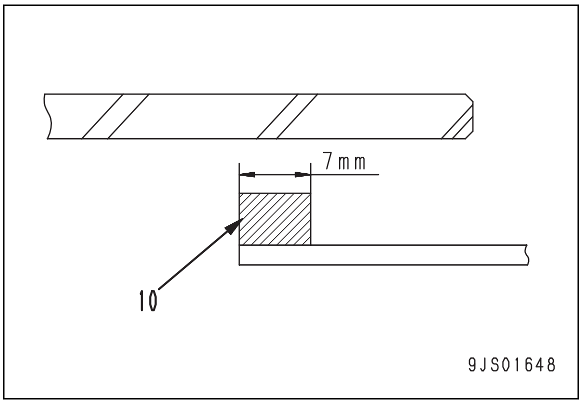


★ When sticking both-sided adhesive tape around a frame, do not lap its finishing end over the starting end, or you may make a clearance of about 5 mm between them.
★ Referring to the following, install the both-sided adhesive tape to each glass sticking part.

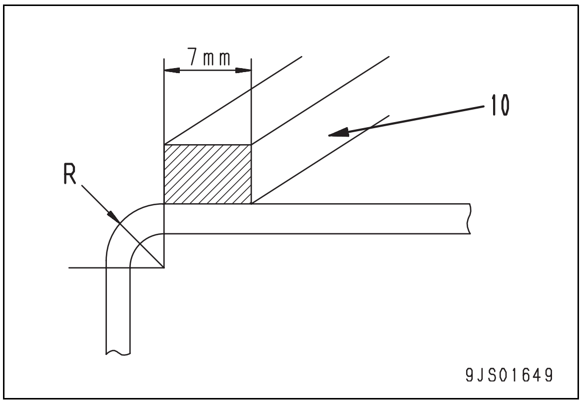
Sliding sash
★ Install the both-sided adhesive tape along the periphery of the sticking face of the sash.



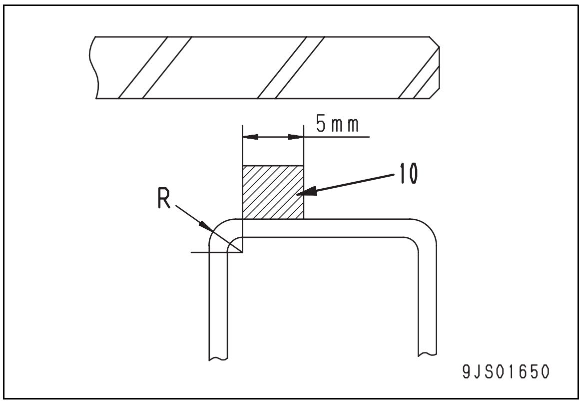
Sheet metal part
★ Install the both-sided adhesive tape along the edge of the sheet metal part.



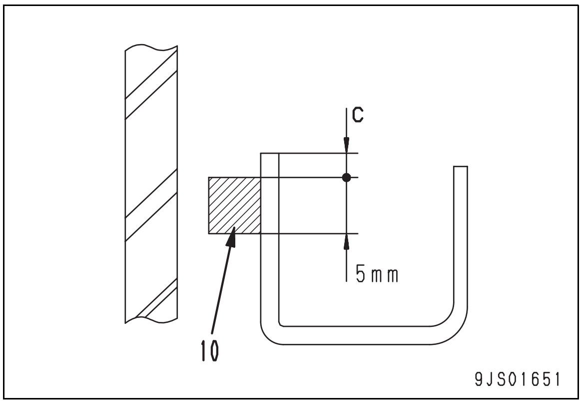
Pipe
★ Install the both-sided adhesive tape from the end of the round part of each corner of the pipe.



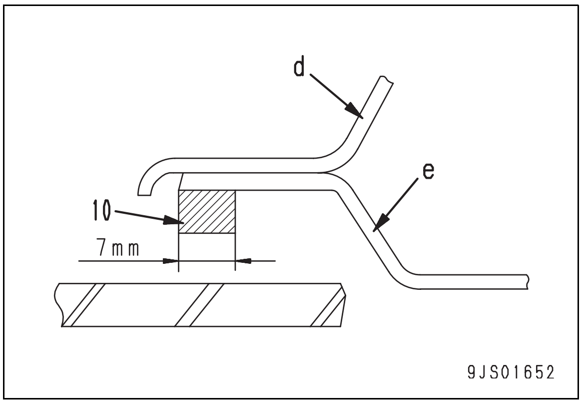
Front sash (Glass sticking side)
- Right and left frames



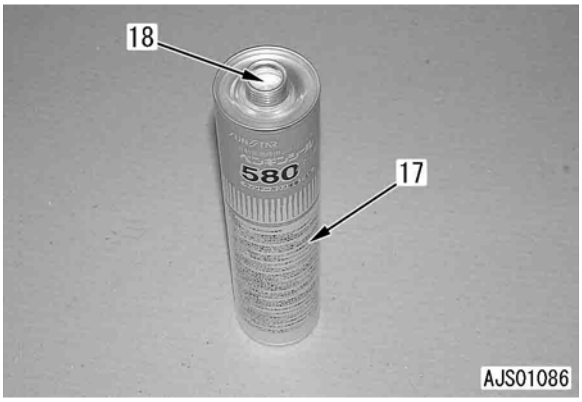
- Bottom frame
- Dimension (**c**): **2.4 mm**



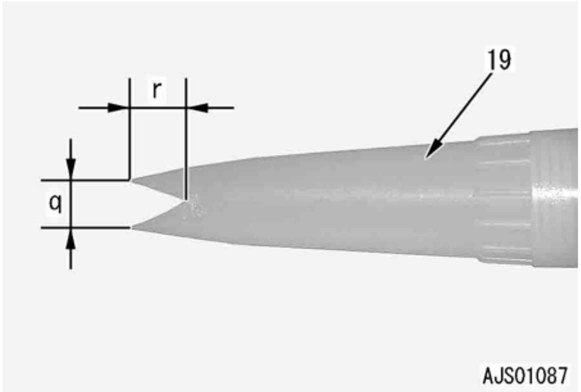
Door (Glass sticking side)
★ Install the both-sided adhesive tape along the outer end of the door.
- **d**: Inner, **e**: Outer



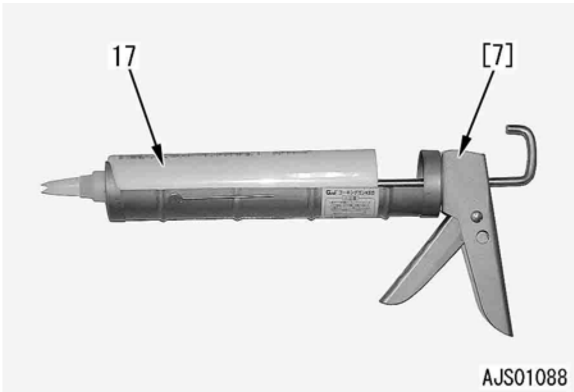
5. Apply adhesive.
   ★ The using limit of the adhesive is 6 months after the date of manufacture. Do not use the adhesive after this limit.
   ★ Keep the adhesive in a dark place where the temperature is below 25°C.
   ★ Never heat the adhesive higher than 30°C.
   ★ When reusing the adhesive, remove the all hardened part from the nozzle tip.
   1) Break aluminum seal (18) of the outlet of adhesive cartridge (17) and install the nozzle.



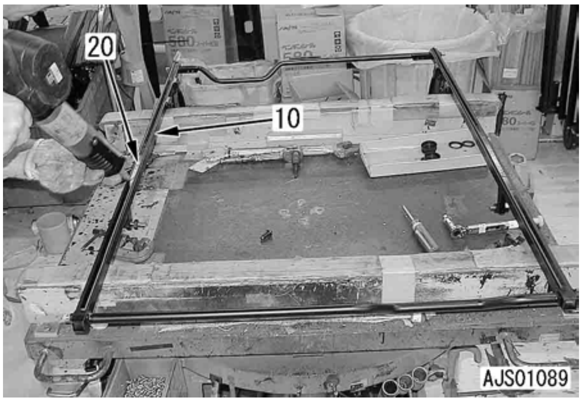
2) Cut the tip of the adhesive nozzle (19) so that dimensions (**q**) and (**r**) will be as follows.
   - Dimension (**q**) : **10 mm**
   - Dimension (**r**) : **15 mm**



3) Set adhesive cartridge (17) to caulking gun [7].
   ★ An electric caulking gun is more efficient.

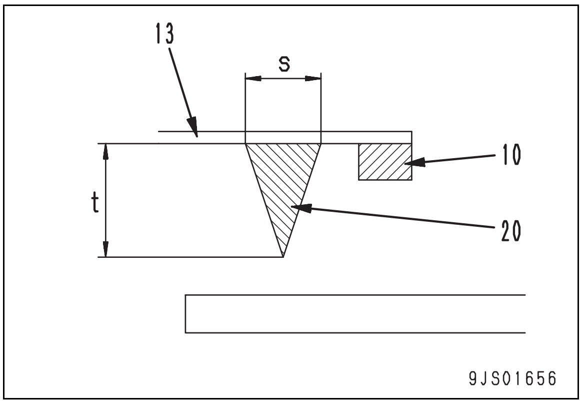


4) Remove the release tape of the both-sided adhesive tape on the glass side.
5) Apply adhesive (20) to the outside of both-sided adhesive tape (10) of the operator's cab.
   Adhesive:
   SUNSTAR PENGUINE SUPER 560

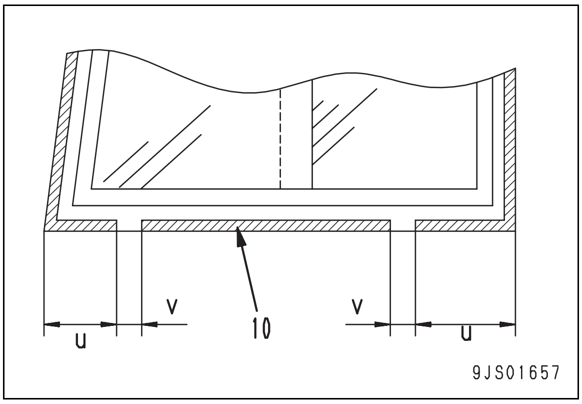


★ Apply adhesive (20) to dimensions (**s**) and (**t**) of both-sided adhesive tape (10) of operator's cab (13).
   - Dimension (**s**) : **10 mm**
   - Dimension (**t**) : **15 mm**

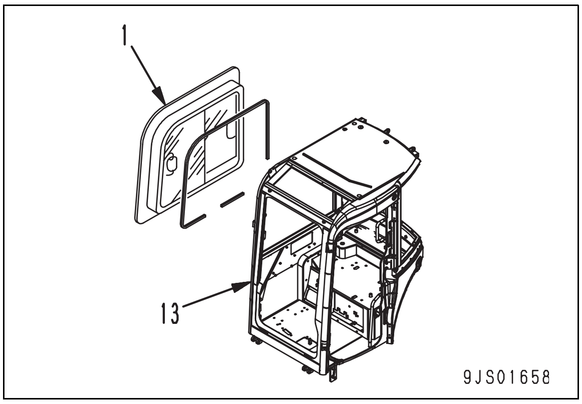
★ Apply adhesive (20) higher than both-sided adhesive tape (10).
★ Apply the adhesive evenly.



6. Install the sliding sash assembly.
   1) Clean the sash sticking face on the cab side and the sash flange sticking face with cleaning solvent according to steps 1 and 2 above.
   2) Apply the primer according step 3 above.
      ★ Use the right primer for the right sash.
      ★ When sash has metallic shine:
      Primer: SUNSTAR PRIMER GP-402 for sash
      ★ When sash is painted black and does not have metallic shine:
      Primer: SUNSTAR PRIMER 435-95 for painted surface
      ★ Do not apply the primer to the following water draining area.
   3) Install the both-sided adhesive tape according to step 4 above.
      ★ To drain water from around the sash, avoid installing both-sided adhesive tape (10) of the bottom side to the area of dimension (**v**).
      • Dimension (**u**): **150 mm**, (**v**): **50 mm**



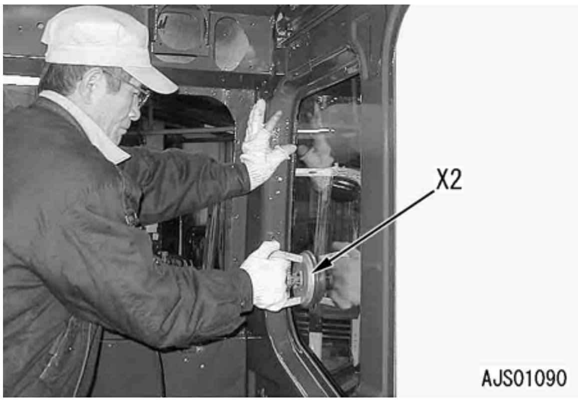
   4) Apply the adhesive according to step 5 above.
      ★ Do not apply the adhesive to the above water draining area.
   5) Install sliding sash assembly (1) to operator's cab (13).
      ★ Press the sash assembly firmly to eliminate clearance from its periphery.
      ★ If the adhesive is projected, wipe it off immediately before it is set.



   6) After installing the sliding sash assembly, fix it with bands, etc. for about 10 hours.

7. Install the window glass and clear plate.
   1) Clean the glass sticking face on the cab side and the sticking face of the glass with cleaning solvent according to steps 1 and 2 above.
   2) Apply the primer according step 3 above.
   3) Install the both-sided adhesive tape according to step 4 above.
   4) Apply the adhesive according to step 5 above.
   5) Stick the glass to the cab.
      ★ Since the window glass cannot be removed and stuck again, stick it very carefully.
      ★ Stick the glass within 5 minutes after applying the adhesive.
   6) After sticking the window glass, press all around it until it is stuck to the both-sided adhesive tape.
      ★ Press the corners of the window glass firmly, in particular.
      ★ You can perform this work efficiently by pulling the window glass from inside of the operator's cab with lifter **X2**.

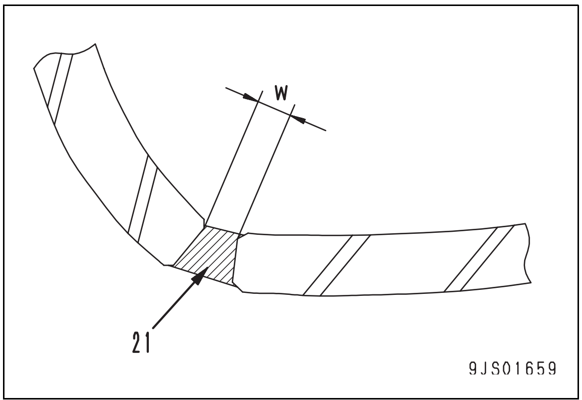
(The figure shows the operator's cab of PC200-7.)



★ Make a clearance of the following dimension in each corner joint of the rear glass and fix the joint with caulking material (21).

- Dimension (**w**): **3 mm**

Caulking material:
GE TOSHIBA SILICONE TOS SEAL 381

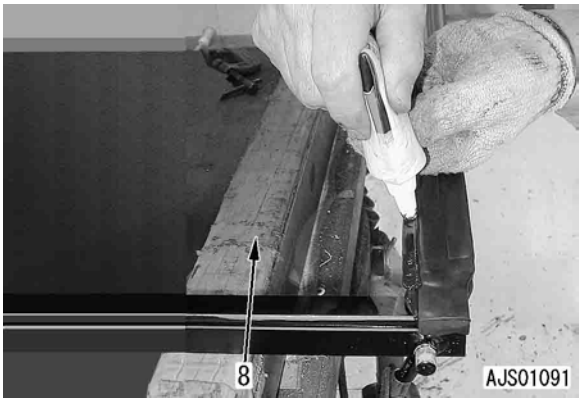


7) After sticking the glass, fix it with bands, etc. for about 10 hours.

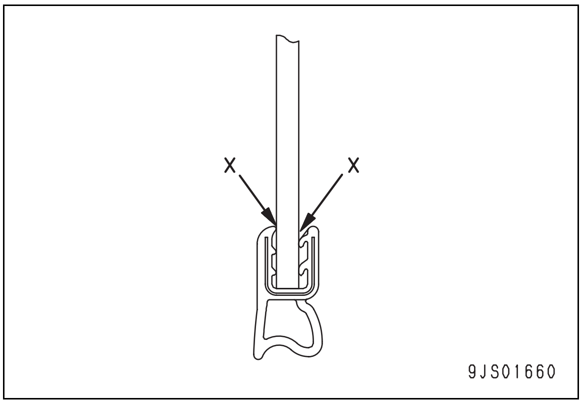
8. Protect the stuck window glass.
   1) Keep the stopper rubbers, styrene foam blocks, and rubber bands installed for 10 hours (at temperature of 20°C and humidity of 60%).
   2) After removing the stopper rubbers, styrene foam blocks, and rubber bands, wait at least 14 hours, at least 24 hours in total, before operating the machine actually.
      ★ After installing front window glass (8), install the center trim seal to its bottom.

★ When caulking, neatly arrange the form of the adhesive at the right and left ends with a rubber spatula.

Adhesive:
Sikaflex 256HV manufactured by Sika Japan



★ Apply caulking material all around the glass to fill part (**x**) between the glass and center trim seal.



REMOVAL AND INSTALLATION OF FRONT WINDOW ASSEMBLY

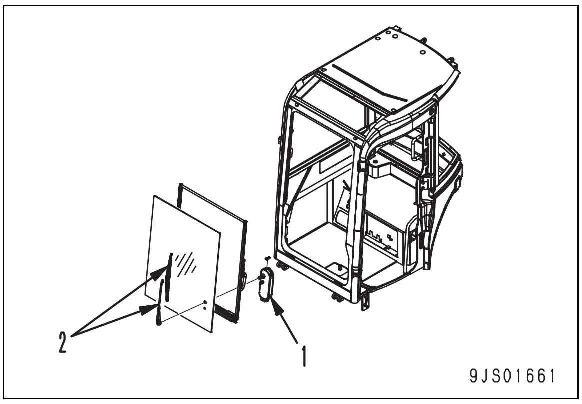
⚠ Lower the work equipment to the ground and stop the engine.

★ To replace the front window glass, the front window assembly must be removed from the operator's cab. The procedure for removing and installing the front window assembly (front frame and front window glass) is explained below.

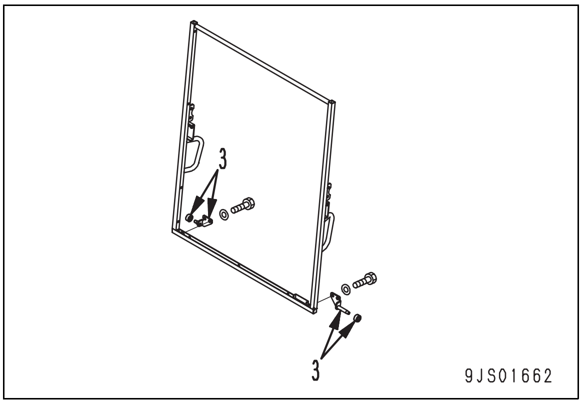
REMOVAL

1. Lower the front window assembly.

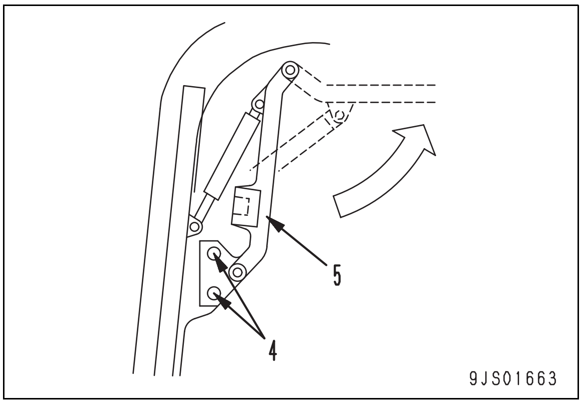
2. Remove wiper motor (1) and wiper blade (2).
   ★ Remove the coiled cable for the wiper from the sash and secure it in the operator's cab.



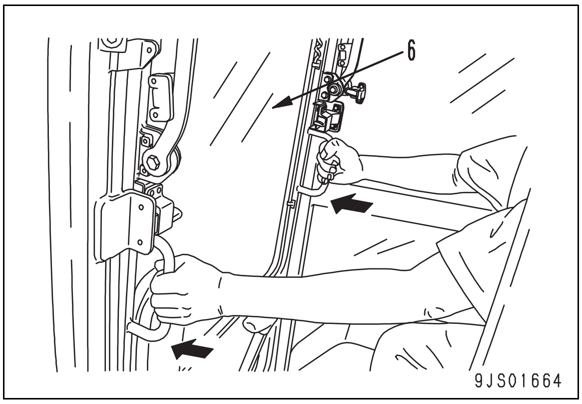
3. Remove rollers (3) (right and left) from the bottom of the sash.



4. Remove bolt (4) and separate pull-up link (5) from the sash and set it up toward the ceiling.



5. Holding the handle, release the latch and remove the front window assembly (6).



INSTALLATION

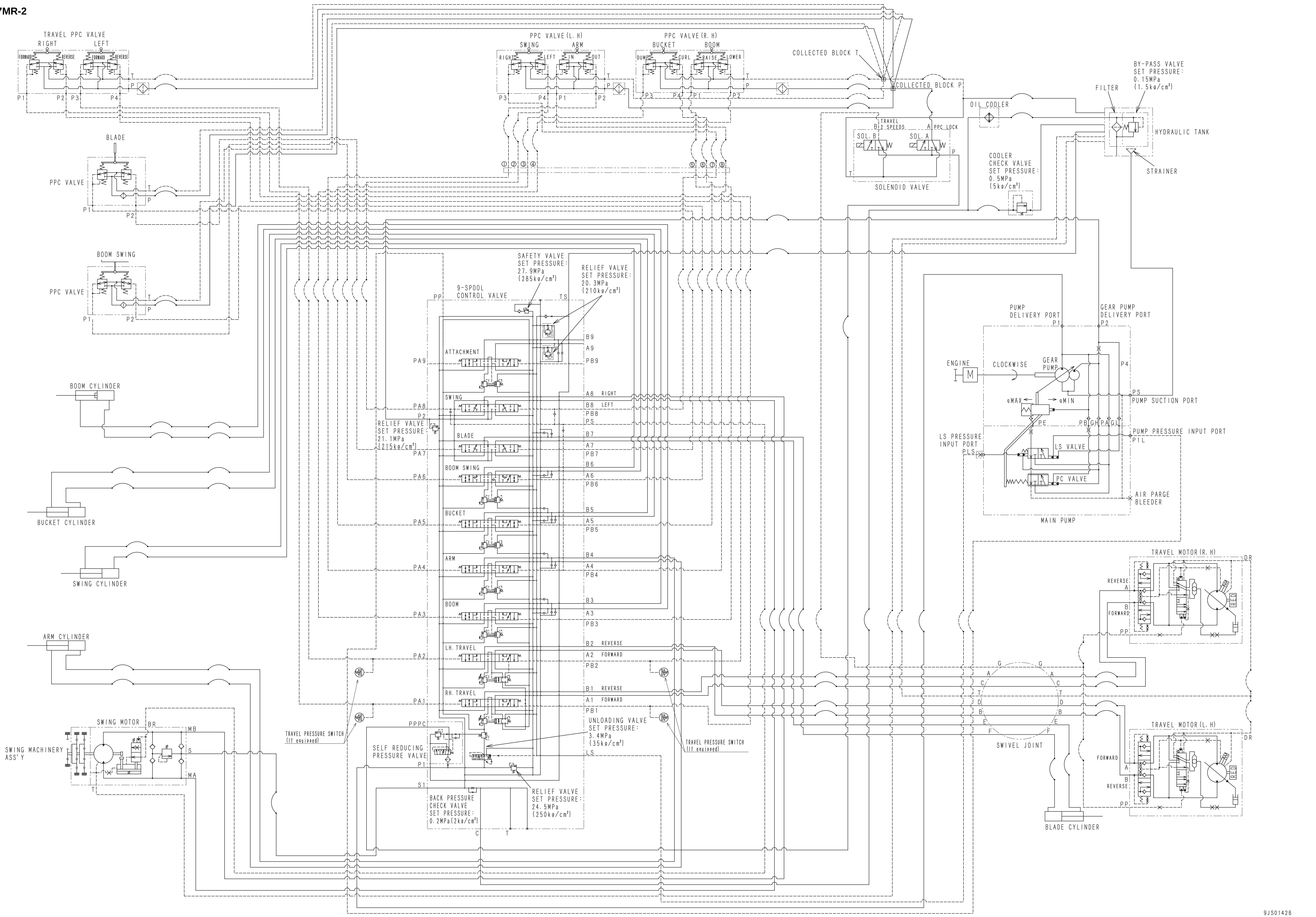
- Carry out installation in the reverse order to removal.

90 OTHERS

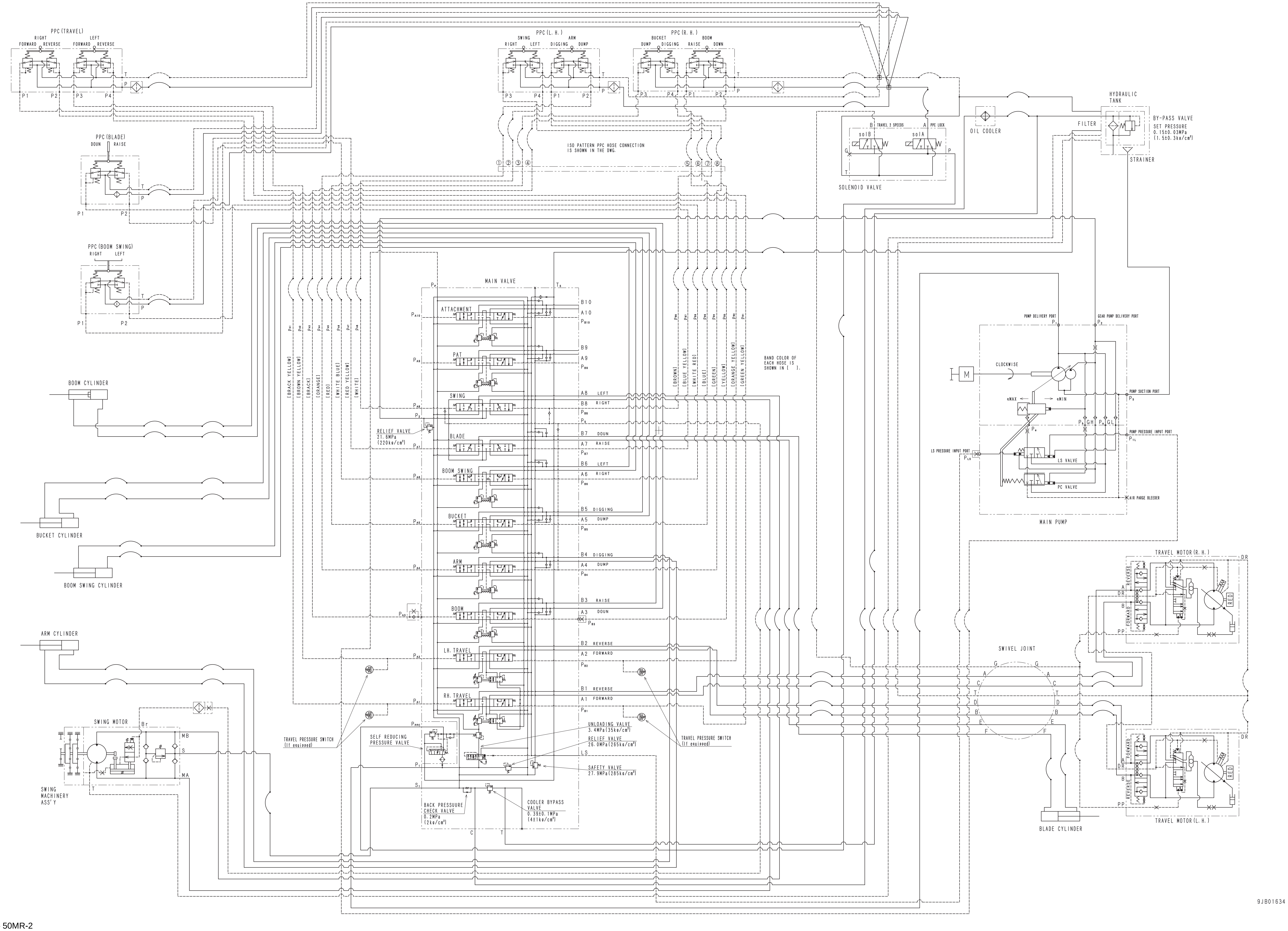
HYDRAULIC CIRCUIT DIAGRAM
PC27MR-2 .... 90- 3
PC30MR-2 .... 90- 5
PC35MR-2 .... 90- 7
PC40MR, 50MR-2 .... 90- 9
PC40MR, 50MR-2 (Additional attachment circuit) 90-11
ELECTRICAL CIRCUIT DIAGRAM
PC27MR, 30MR-2 (1/2) 90-13
PC27MR, 30MR-2 (2/2) 90-15
PC35MR-2 (1/2) 90-17
PC35MR-2 (2/2) 90-19
PC40MR, 50MR-2 (1/2) 90-21
PC40MR, 50MR-2 (2/2) 90-23

HYDRAULIC CIRCUIT DIAGRAM

PC27MR-2

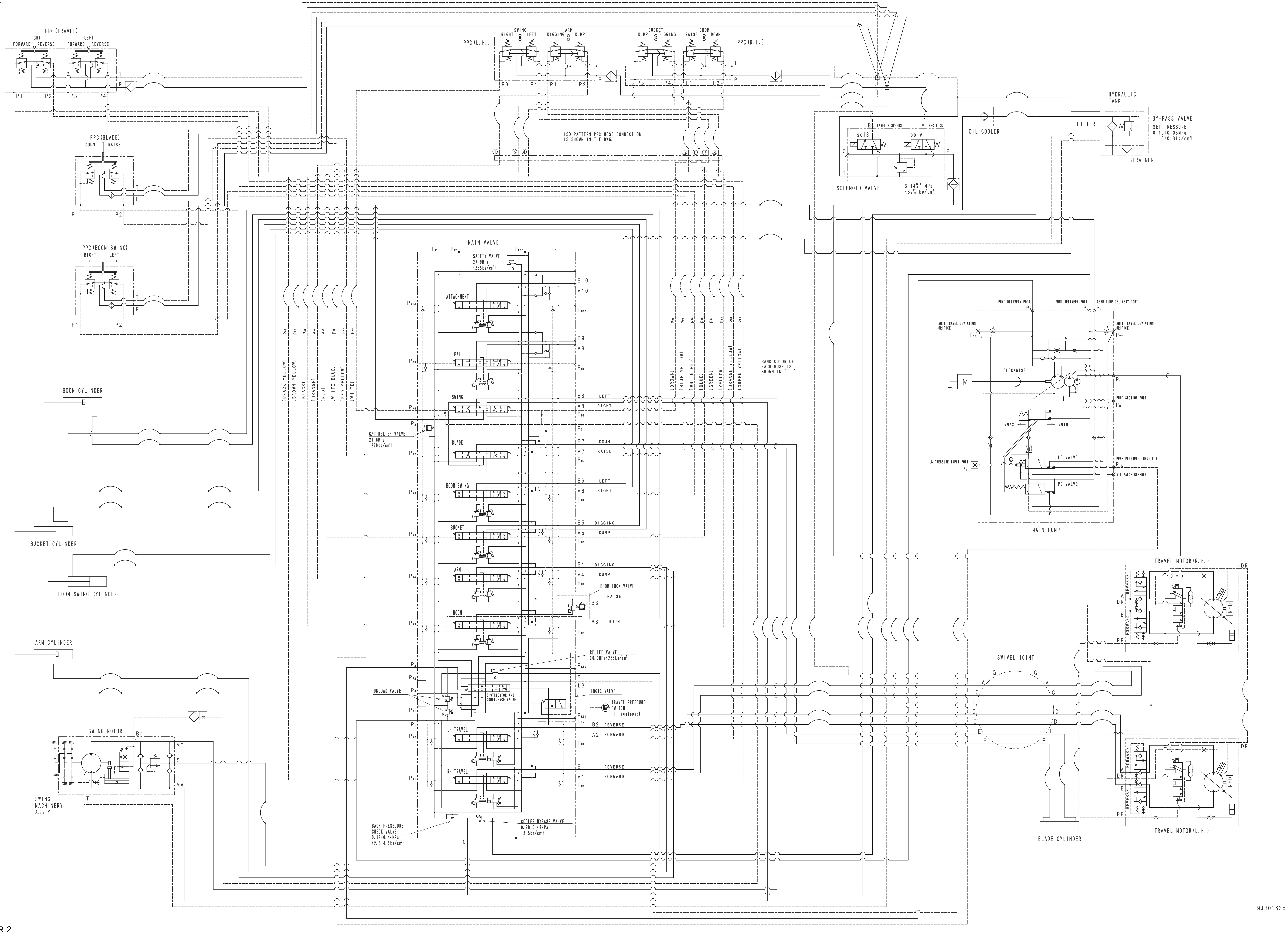


PC30MR-2


PPC (TRAVEL)
PPC (L. H.)
PPC (R. H.)
PPC (BLADE)
PPC (BOOM SWING)
MAIN VALVE
HYDRAULIC TANK
BY-PASS VALVE
OIL COOLER
SOLENOID VALVE
MAIN PUMP
SWIVEL JOINT
TRAVEL MOTOR (R. H.)
TRAVEL MOTOR (L. H.)
BOOM CYLINDER
BUCKET CYLINDER
BOOM SWING CYLINDER
ARM CYLINDER
BLADE CYLINDER
SWING MOTOR
SWING MACHINERY ASS'Y
9JB01634

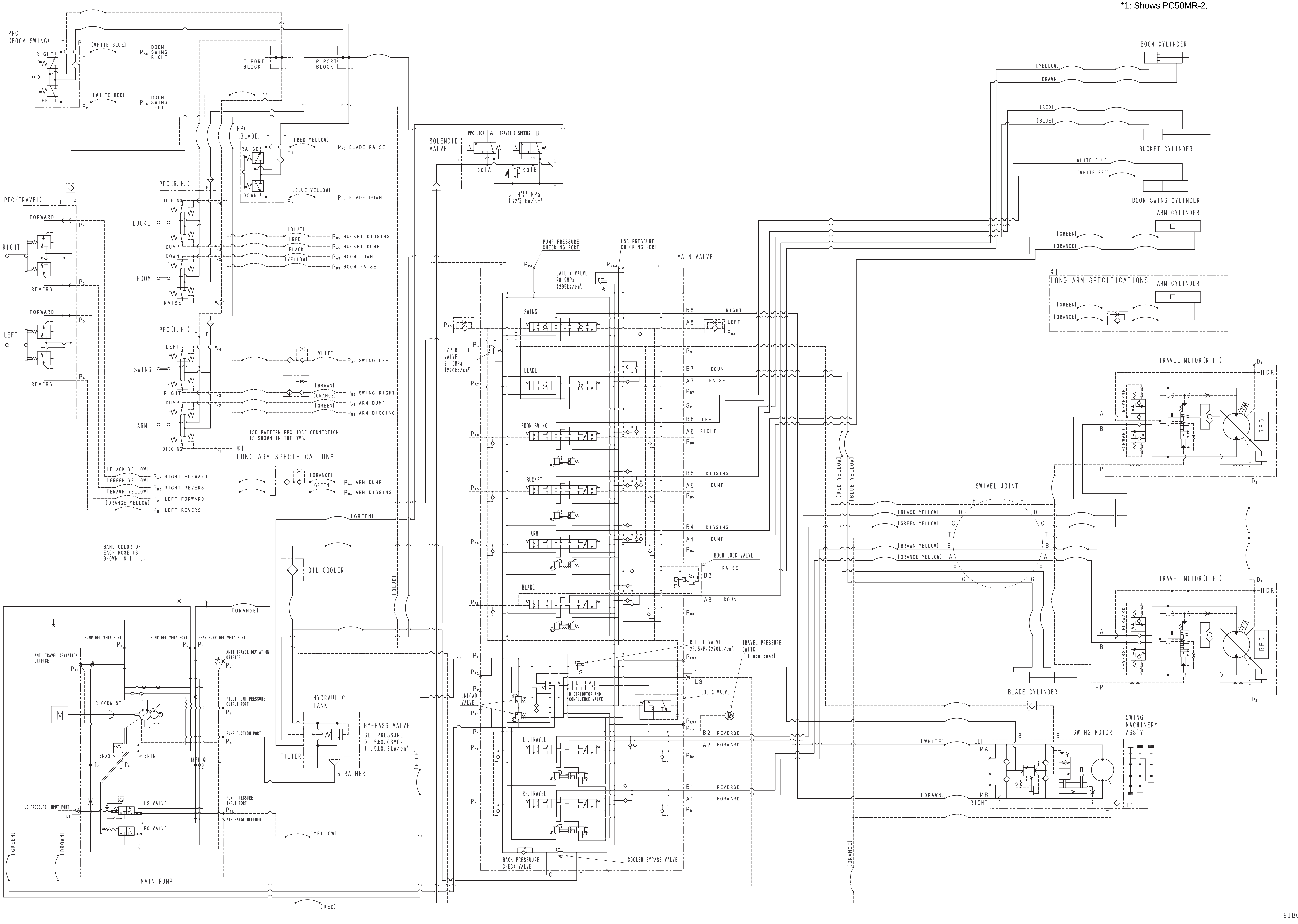
HYDRAULIC CIRCUIT DIAGRAM

PC35MR-2



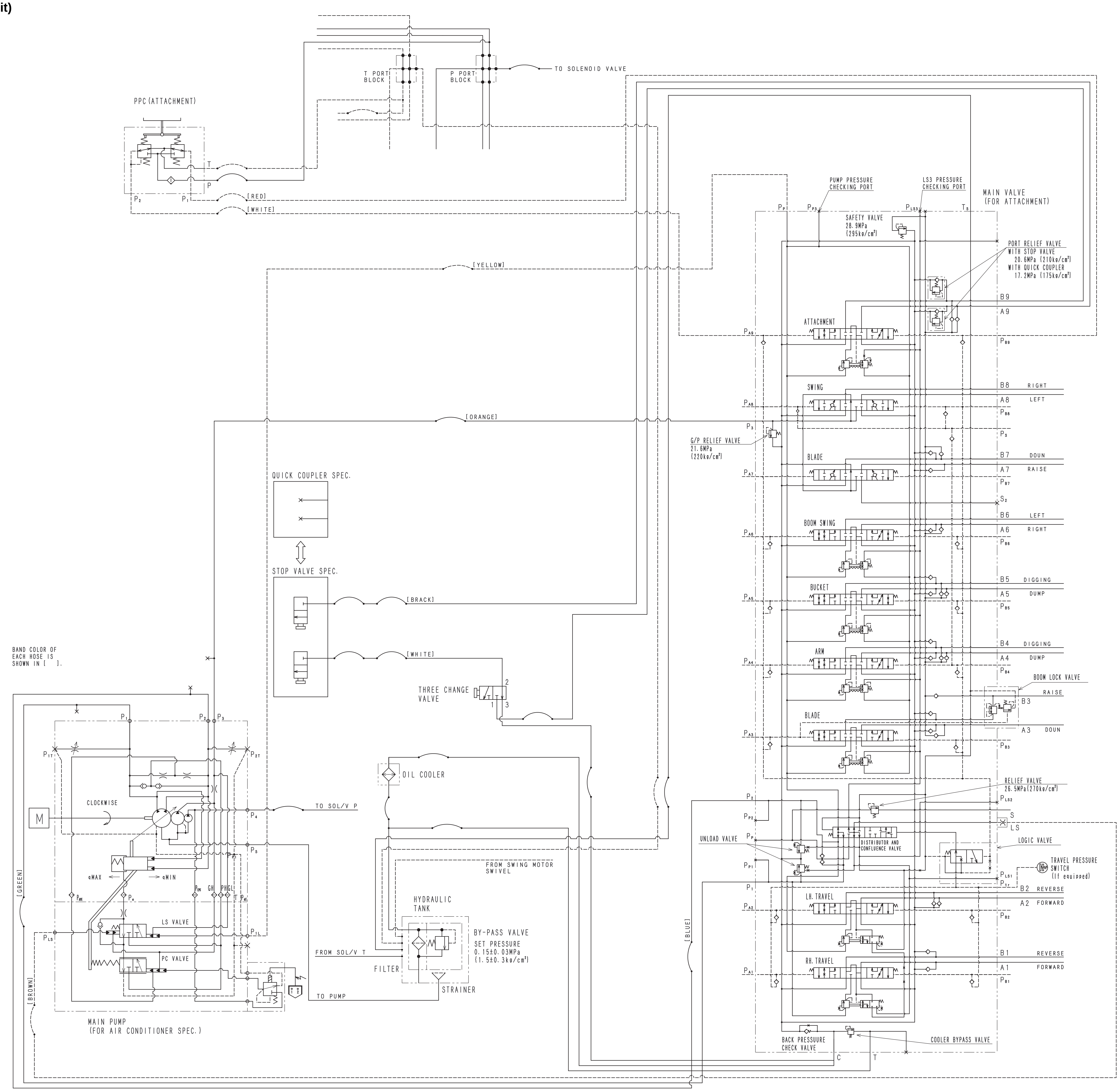
PC40MR, 50MR-2

*1: Shows PC50MR-2.



HYDRAULIC CIRCUIT DIAGRAM

PC40MR, 50MR-2
(Additional attachment circuit)



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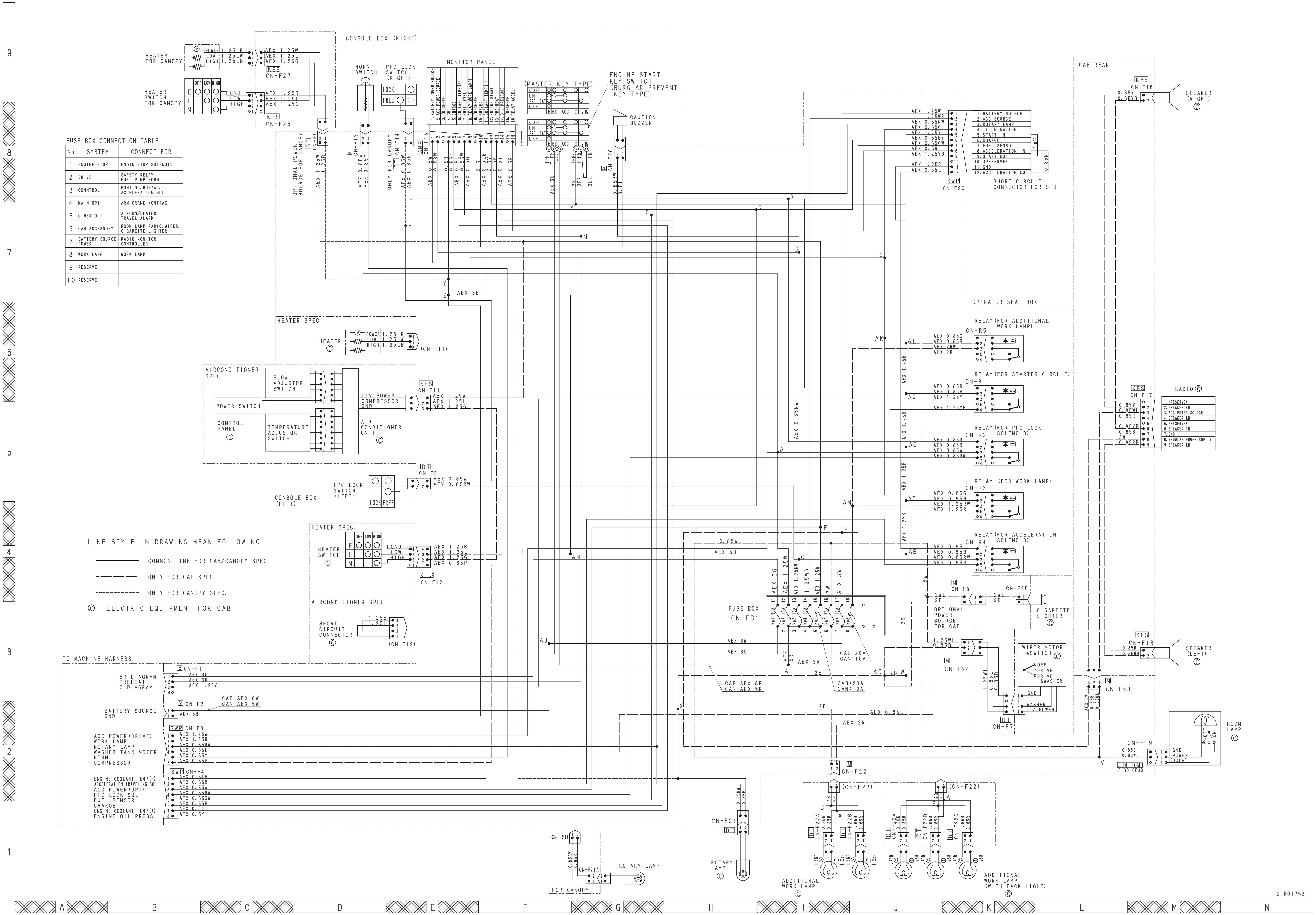
ELECTRICAL CIRCUIT DIAGRAM

PC27MR, 30MR-2
(1/2)



FUSE BOX CONNECTION TABLE

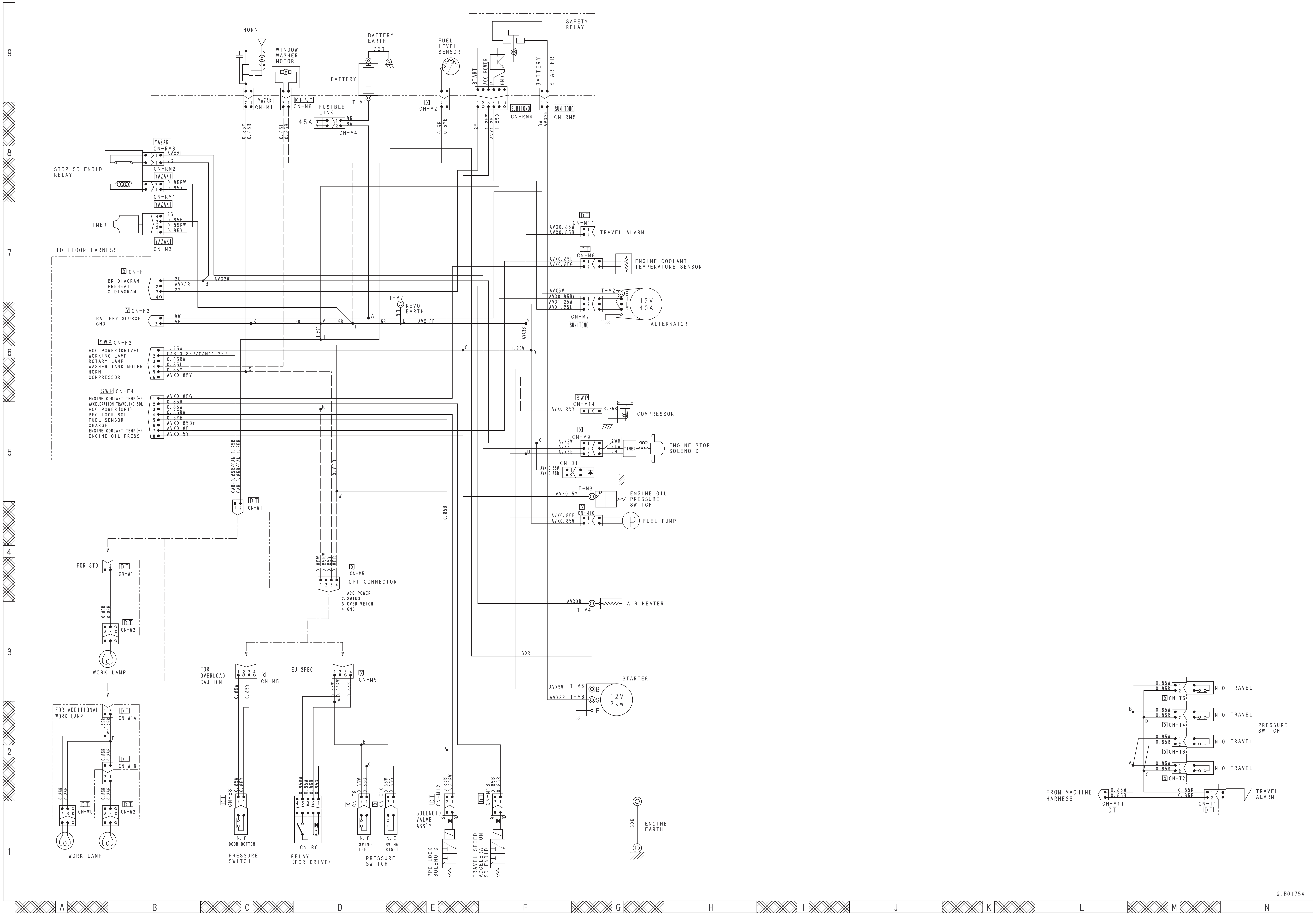
No	SYSTEM	CONNECT FOR
1	ENGINE STOP	ENGIN STOP SOLENOID
2	DRIVE	SAFETY RELAY, FUEL PUMP, HORN
3	CONNTROL	MONITOR, BUZZAR, ACCELERATION SOL
4	MAIN OPT	ARM CRANE, KOMTRAX
5	OTHER OPT	AIRCON/HEATER, TRAVEL ALARM
6	CAB ACCESSORY	ROOM LAMP, RADIO, WIPER, CIGARETTE LIGHTER
7	BATTERY SOURCE POWER	RADIO, MONITOR, CONTROLLER
8	WORK LAMP	WORK LAMP
9	RESERVE	
10	RESERVE	

LINE STYLE IN DRAWING MEAN FOLLOWING

- COMMON LINE FOR CAB/CANOPY SPEC.
- ONLY FOR CAB SPEC.
- ONLY FOR CANOPY SPEC.
- Ⓒ ELECTRIC EQUIPMENT FOR CAB

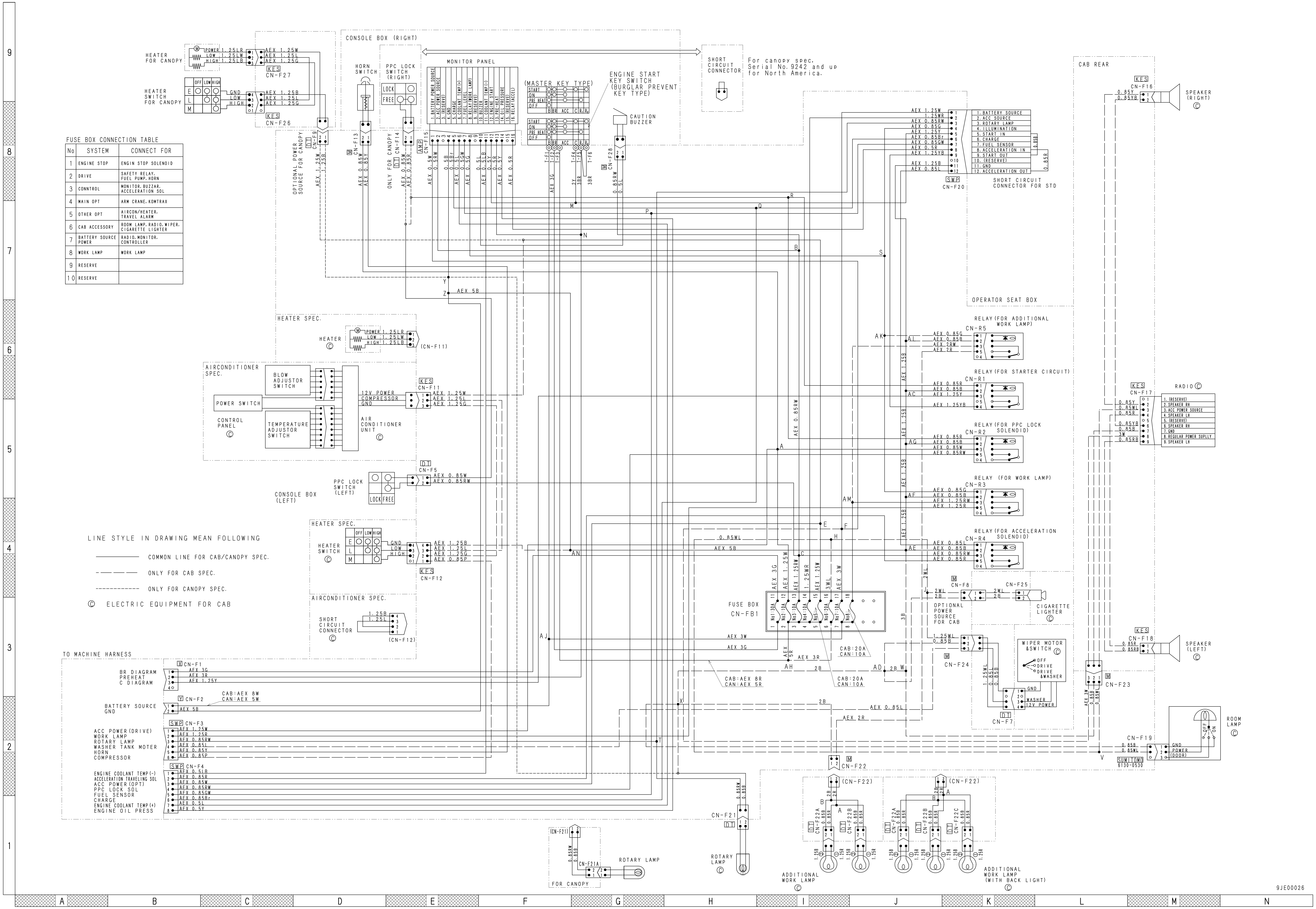
ELECTRICAL CIRCUIT DIAGRAM

PC27MR, 30MR-2
(2/2)



ELECTRICAL CIRCUIT DIAGRAM

PC35MR-2
(1/2)



FUSE BOX CONNECTION TABLE

No	SYSTEM	CONNECT FOR
1	ENGINE STOP	ENGIN STOP SOLENOID
2	DRIVE	SAFETY RELAY, FUEL PUMP, HORN
3	CONNTROL	MONITOR, BUZZAR, ACCELERATION SOL
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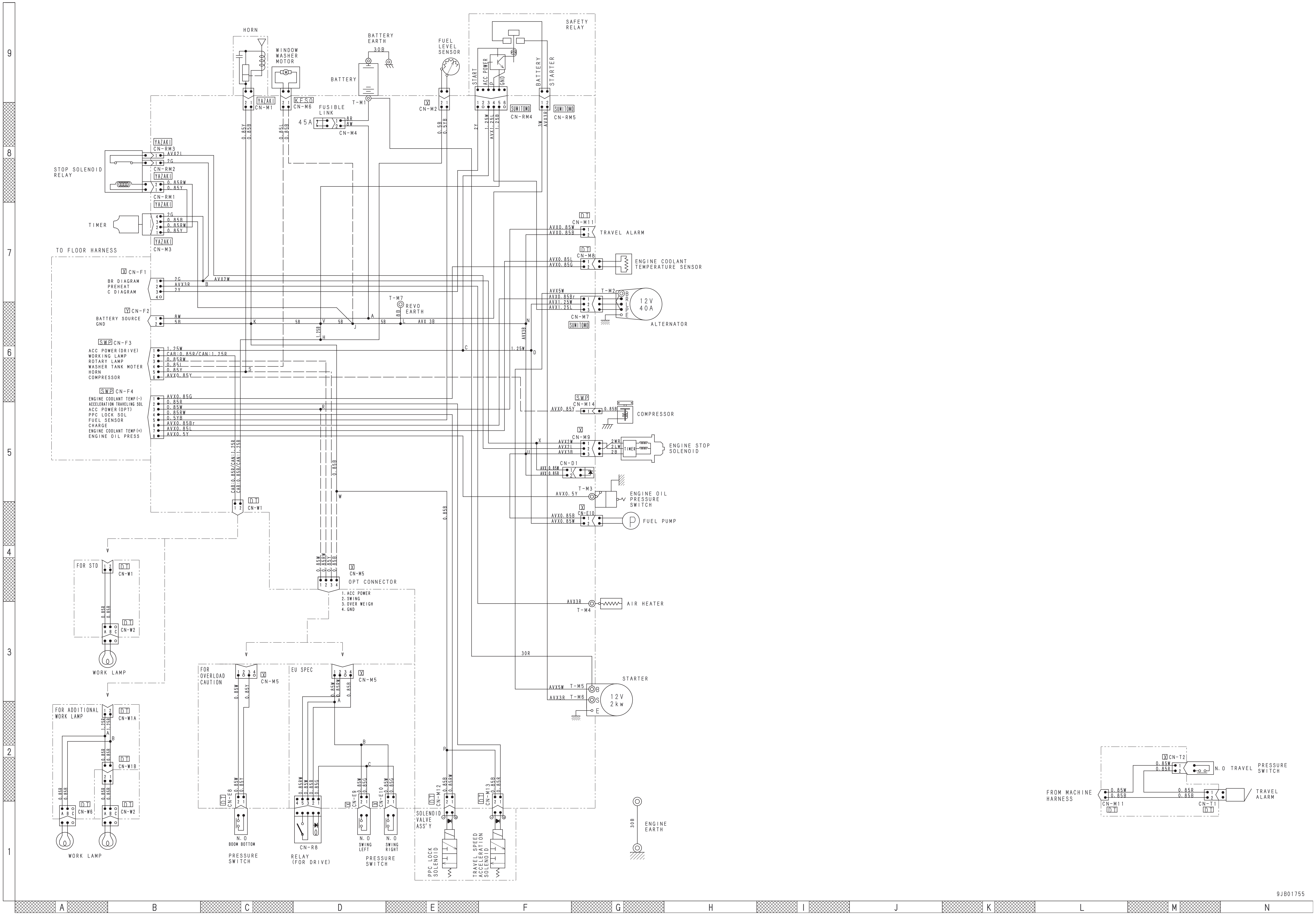
6	CAB ACCESSORY	ROOM LAMP, RADIO, WIPER, CIGARETTE LIGHTER
7	BATTERY SOURCE POWER	RADIO, MONITOR, CONTROLLER
8	WORK LAMP	WORK LAMP
9	RESERVE	
10	RESERVE	

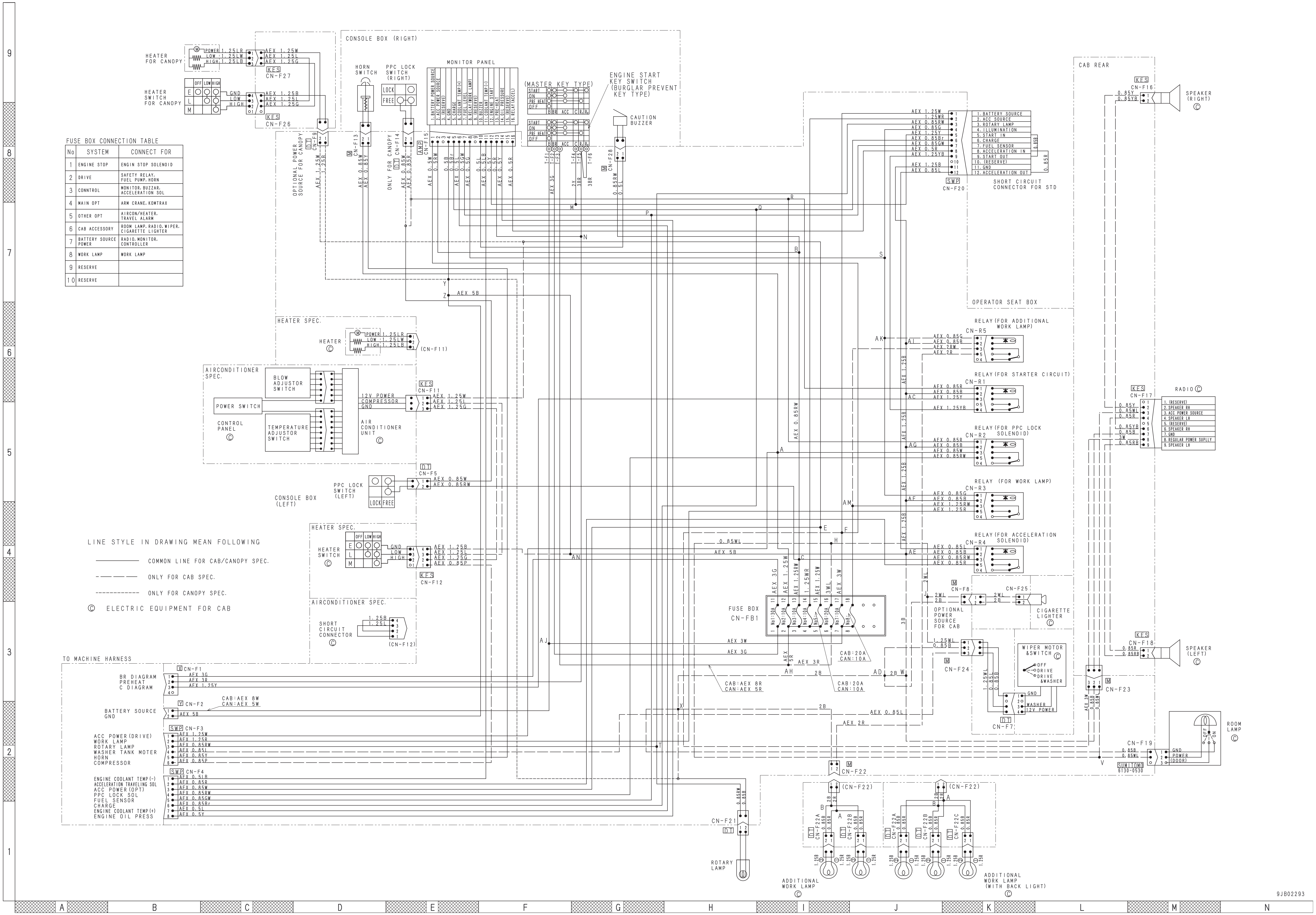
ELECTRICAL CIRCUIT DIAGRAM

PC35MR-2
(2/2)



ELECTRICAL CIRCUIT DIAGRAM

PC40MR, 50MR-2
(1/2)



FUSE BOX CONNECTION TABLE

No	SYSTEM	CONNECT FOR
1	ENGINE STOP	ENGIN STOP SOLENOID
2	DRIVE	SAFETY RELAY, FUEL PUMP, HORN
3	CONNTROL	MONITOR, BUZZAR, ACCELERATION SOL
4	MAIN OPT	ARM CRANE, KOMTRAX
5	OTHER OPT	AIRCON/HEATER, TRAVEL ALARM
6	CAB ACCESSORY	ROOM LAMP, RADIO, WIPER, CIGARETTE LIGHTER
7	BATTERY SOURCE POWER	RADIO, MONITOR, CONTROLLER
8	WORK LAMP	WORK LAMP
9	RESERVE	
10	RESERVE	

LINE STYLE IN DRAWING MEAN FOLLOWING

COMMON LINE FOR CAB/CANOPY SPEC.
ONLY FOR CAB SPEC.
ONLY FOR CANOPY SPEC.
Ⓒ ELECTRIC EQUIPMENT FOR CAB

ELECTRICAL CIRCUIT DIAGRAM

PC40MR, 50MR-2
(2/2)